ANNUAL REPORT

OF THE

State Engineer and Surveyor

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OF THE

STATE OF NEW YORK.

For the Fiscal Year Ending September 30, 1901.

TRANSMITTED TO THE LEGISLATURE JANUARY 22, 1902.

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1902

STATE OF NEW YORK.

No. 31.

IN ASSEMBLY,

JANUARY 22, 1902.

ANNUAL REPORT

OF THE

STATE ENGINEER AND SURVEYOR

OF NEW YORK.

OFFICE OF THE STATE ENGINEER AND SURVEYOR,
ALBANY, N. Y., *January* 22, 1902.

To the Honorable the Speaker of the Assembly:

Sir:—I have the honor to transmit herewith my annual report for the fiscal year ending September 30, 1901.

EDWARD A. BOND,
State Engineer and Surveyor.

REPORT.

To the Honorable the Legislature of the State of New York:

I have the honor to present herewith my third annual report as State Engineer and Surveyor of New York.

This Department is charged by the provisions of the Constitution, by the Revised Statutes and by laws passed at each session of the Legislature with the duty of designing and supervising the various engineering operations for the construction and maintenance of the public works of the State.

These works are varied and extensive and the duties and responsibilities for them are constant and exacting. The further duties of the office of the State Engineer are those which are incident to his membership of the various commissions and boards of which the State Engineer and Surveyor is a member. From the several boards many subjects are referred to him for examination and report.

These boards and their duties are as follows:

The Canal Board.—Controlling the construction and maintenance of canals, and also hearing and adjudicating the claims of contractors for work done under the nine million improvement of 1895-97.

The Board of Commissioners of the Land Office.—Controlling the sale and purchase of State lands, and the granting of lands under water.

The State Board of Health.—Controlling the approval of designs and the manner of construction of proposed systems of sewers, all of which were referred to the State Engineer. The

board also controlled all matters concerning the public health, especially those affecting contamination of streams and water supplies, until February 19, 1901, when the board was abolished by chapter 29 of the Laws of 1901.

The Board of State Canvassers.—Charged with the duty of canvassing the returns of elections.

The Board of Quarantine Commissioners.—Having control of the Quarantine establishment of the port of New York.

The Forest Preserve Board.—Authorized to purchase and to perfect titles of land for the Forest Preserve. The State Engineer continued to be a member of this board until March 22, 1901, when it was abolished by chapter 94 of the Laws of 1901.

The Board of Equalization of Assessment.—Charged with the duty of equalizing assessments of State taxes among the several counties.

The principal duty of the State Engineer and Surveyor continues to be the design, construction and maintenance of the canal system of the State, and of such extensions thereof as may be required by the Legislature and by the people of the State.

The State Engineer is also charged with the duty of designing and constructing improved highways throughout the State under the provisions of chapter 115 of the Laws of 1898, known as the Higbie-Armstrong State Aid Law.

HISTORY OF CANAL.

At the present time the canal problem of the State is in its fifth stage since its origin in 1768, when Sir Henry Moore, Colonial Governor of New York, proposed improvements of the Mohawk river at Canajoharie, and in 1788, when Elkanah Watson proposed improving the natural channels by way of the Mohawk river to Wood creek, and thence through Oneida lake to the Oswego river and to Lake Ontario. This latter project was so far executed as to give navigation in 1796 for boats carrying sixteen tons from Schenectady westward 184 miles by the water route, or 150 miles in a direct line, to Seneca Falls, on the outlet

of Seneca lake, the locks being first of wood, then of brick and finally of stone.

The second step was taken in 1808, when the Legislature directed Surveyor-General Simeon DeWitt to cause an accurate survey to be made of a route between the Hudson river and Lake Erie; the results of this survey were under consideration and discussion until 1816, when the Canal Law was passed authorizing the construction of the Erie and Champlain canals, which were begun in 1817 and completed in 1825; the section to Lake Ontario at Oswego being begun in 1825 and completed in 1828. The waterway of the Erie canal and of the Oswego canal was then 28 feet wide at bottom, 40 feet wide at surface of water, whose depth was four feet, the locks being 90 feet long by 12 feet wide. The Champlain canal was 20 feet by 30 feet wide with 3 feet depth of water and the locks 75 feet by 10 feet.

The commercial success of this canal was so great that the third step was taken in 1835 when the enlargement of the Erie and the Oswego canals was begun and was completed in 1862, when the dimensions of the waterways were 52½ feet at the bottom and 70 feet at the surface of water, whose depth was 7 feet. The locks were 110 feet long by 18 feet wide, allowing passage of boats carrying 250 tons of freight, and on the Erie canal were built in pairs.

The fourth step was suggested in 1878 when the State Engineer in his annual report proposed a further enlargement and briefly formulated what has since been known as the "Seymour Plan" which was to "increase the depth of the canal to eight feet by lowering the bottom in some places and raising the banks in others." This step was further advanced in 1895, when the people of the State voted $9,000,000 to thus increase the depth to nine feet in the waterway and eight feet in the locks and aqueducts, this being now known as the Seymour-Adams plan of 1895.

The fifth step is now begun by my report on the surveys and estimates for a barge canal referred to Governor Odell on Febru-

ary 12, 1901, which was considered by the Legislature at its last session.

At the same time a United States commission has had in preparation a report and estimates for 21-feet and 30-feet ship canals through the State. Four years of time and $485,000 of money have been used in the preparation of this United States report which was presented to Congress on December 1, 1901.

On March 15, 1901, Governor Odell presented my report on barge canal to the Legislature with the following message:

STATE OF NEW YORK.

No. 38.

IN SENATE,

MARCH 15, 1901.

MESSAGE FROM THE GOVERNOR, TRANSMITTING REPORT OF THE STATE ENGINEER AND SURVEYOR ON THE SURVEY FOR THE PROPOSED BARGE CANAL, AND ALSO ESTIMATE FOR COMPLETING THE CANAL UNDER THE LAWS OF 1895.

STATE OF NEW YORK:

EXECUTIVE CHAMBER,

ALBANY, *March* 15, 1901.

To the Legislature:

I herewith transmit the report of the State Engineer and Surveyor, who, acting under authority of chapter 411 of the Laws of 1900, has surveyed the different routes provided for in that act, with a statement in detail of the result of his investigations and the estimated cost of the different routes proposed. In addition to the report herewith submitted, the State Engineer also submits an estimate of the cost of completing the canal under the Laws of 1895, commonly known as the Nine Million Dollar Act.

This report, together with the supplemental statement of the State Engineer, places before you five different methods of improving the canal, the first four of which provide for a barge canal, with the necessary locks, for two barges 25 feet wide, 10 feet draft and 150 feet long, while the supplemental report provides for a canal suitable for boats 98 feet long, 17½ feet wide and 7 or 7½ feet draft, the capacity of the barges being 1,000 tons and of the latter 315 and 340 tons.

The first route proposed is by way of the Mohawk and Seneca rivers, the distance from Troy to Buffalo being 342.56 miles, including improvements to the Oswego canal from Three River Point to Oswego, nine miles, and the Champlain canal from Troy to Whitehall, at a total cost of $78,496,446, from which estimate the value of abandoned lands is to be deducted, amounting on the

Erie canal to $1,941,380, and upon the Champlain canal $22,620, which leaves the net cost $76,532,446.

The second route proposed is by way of the Mohawk and Oswego rivers, via Olcott to Buffalo, using Lake Ontario, a total distance of 338.66 miles, with improvements to the Erie canal amounting to $46,765,755, the Oswego canal amounting to $5,170,-129, and the Champlain canal at a cost of $4,750,608, making the total gross cost $56,686,492, from which is to be deducted the estimated value of abandoned lands on the Erie canal $1,953,202, the Oswego canal $2,391, and on the Champlain canal $22,620, leaving the net cost $54,708,279.

The third route is by way of the Mohawk and Oswego rivers and Lake Ontario, via Lewiston to Buffalo, a total distance of 347.57 miles, at a total cost of $48,984,220 for the Erie canal, $5,170,129 for the Oswego canal and $4,750,608 for the Champlain canal, making a total cost of $58,904,957, from which should be deducted the value of abandoned lands as above in the case of the Oswego-Mohawk canal, leaving the net total cost $56,926,744.

The fourth plan is by way of the present canal, modified, from Troy to Buffalo, 347.66 miles, at a cost of $81,578,854; for improving the Oswego canal $1,481,012 and the Champlain canal $5,787,929, making a total cost of $88,847,795, from which is to be deducted the estimated value of abandoned lands on the Erie canal $1,530,225, leaving the net cost $87,317,570. To this total should be added the improvement of the Hudson river from Troy to Watervliet, $737,683, and improving Black Rock harbor, $538,-051, a total of $1,275,734. These latter items are to be added to each of the above estimates if the United States government does not do this work.

The improvement of the canals along the Nine Million Dollar plan, under the act of 1895, would amount to $19,797,828, divided as follows: The Eastern Division, $5,825,386; the Middle Division, $2,086,987; the Western Division, $7,060,950; the Champlain canal, $2.689,117; and the Oswego canal, $2,135,388. To this is to be added the value of property taken or injured by this improvement.

The question of improving the canal system or abandoning it altogether is thus presented for your consideration, and it may be well in this connection to study the subject from an economical as well as from a business standpoint. Whether the canals have outlived their usefulness, whether if abandoned increased railroad charges would result, are questions of grave import, and should be carefully weighed and considered, so that a conclusion may be reached and the course the State shall pursue with reference to the canal system established.

First, let us understand the cost, and what it means to the taxpayers of the State if any of the proposed plans are chosen. It may be assumed that money can be borrowed at 3 per cent. interest. As the bonds are limited by the Constitution to eighteen years, providing for the reduction of such bond issue at the rate of one-eighteenth each year, it would mean that the total cost by

the first plan would be, including interest, $97,197,206.42, or a cost per year of $5,399,789.

The cost by the second plan, including interest, would be $69,-479.514, a total cost per year of $3,859,973.

The total cost by the third plan, including interest, would be $72,296,964, or $4,016,498 per year.

By the fourth plan the total cost would be, including interest, $110,893,313, or $6,160,739 per annum.

By the fifth plan the cost would be, including interest, $25,143,-241, or $1,396,846 per year.

The total cost per $1,000 estimated valuation, based on the present year's valuation of $5,671,363,345, would be $17.14 for the first plan, $12.25 for the second plan, $12.74 for the third plan, $19.55 for the fourth plan, and $4.43 by the fifth plan. In other words, this would be the total mortgage against each $1,000 of valuation of property in the State of New York. It is claimed, and the figures no doubt bear out the statement, that the canal, counting merely the cost resultant from expenditures for construction and improvements, disregarding the interest charges, has more than paid for itself. If, however, we add to this cost the interest upon the investment it is doubtful whether such a conclusion can be drawn.

The average cost of transportation of cereals by railway has been 2.5 mills per ton mile from Buffalo to New York. Under the present Erie canal the cost per ton mile, according to the Greene report, is 1.75 mills, and under the Seymour plan, the act of 1895, if the canal were completed according to those plans, the cost would be 1.16 mills, while under the proposed barge canal it would be .88 mills. This, of course, represents only the carrying charges. and has nothing to do with the interest on the investment. In making a comparison with the railroad charges it should be added. Taking the most favorable basis and estimating that the tonnage would exceed 10,000,000 tons, there should be added, if the fourth plan should be adopted, the interest on the ultimate cost, which would be $110,000,000. This at 3 per cent. would be $3,300,000. Adding this to the mere cost of transportation of .88 mills per ton mile, the result would be 1.54 mills. Completing the canal under the plan of 1895, the new capital would be $25,143,241, which at 3 per cent. interest, and estimating the tonnage at 10,000,000, would be 1.31 mills per ton mile. The only difference in the cost per ton mile between the $25,000,000 plan and the barge canal would be .23 mills per ton mile in favor of the $25,000,000 project. We thus see that from a competitive point of view the canal can under either of these plans carry freight at a lower rate than the railroads, and the rate by both plans being so much below the lowest rate given by the railroads per ton mile, it would seem that the advantages of the large canal were not great enough to warrant the increased expenditure.

Directing attention again to the report of the State Engineer, we find that the economical point at which boats can be moved

is three miles per hour in regular canal prism; three and a half miles in rivers canalized, and 4.4 miles in open water. Mr. Sweet, to whom this question was referred, believes that a higher speed than three miles per hour in the regular canal prism is economically undesirable. He estimates that under the completion of the Nine Million Dollar plan the possible speed of towing six barges of 300 tons each would be two miles per hour, and that the time between Buffalo and the Hudson river would be seven days, while the time by the barge canal would be five and a half days, a difference of less than two days between the two different routes.

While it is true that the report shows the capacity of the barge canal would be 10,000,000 tons and the small canal 8,000,000 tons, both of these figures are very much in excess of the present needed carrying capacity of the canals, and which even when the canal traffic was greater than now was more than adequate to meet all demands.

The cheaper routes by way of Lake Ontario are objectionable because of the dangers incident to traffic on that lake, so that it is probable that but two plans can be examined and that but one of three courses is left for consideration. First, shall the canals be abandoned? Second, shall they be enlarged so as to permit the passage of 1,000 ton barges? Third, shall the improvement begun under the act of 1895 be continued along the line of the route of both the Erie canal and its feeders?

It may be well to consider here what advantage the canal offers in return for the money expended. Is it great enough to warrant the expenditure of this money, and is the commerce of the city of New York so much endangered that steps should be taken by the State at large to protect its present business and bring back the commerce which it is claimed has been lost?

It is assumed, of course, that the canal provides the best means of carrying certain kinds of freight to the seaboard, and that it offers advantages greater than those offered by the railroads, and that its maintenance will prevent unjust discrimination against the Metropolis. In the Greene report it is contended that the development of the canals will have a tendency to bring into the State of New York the iron industry, and it is pointed out that already a large steel mill is being erected at Buffalo, and that it should have easy means of reaching the coast for export. It is not assumed, notwithstanding that to-day it offers lower rates than the railroads, that it can in any event win from the railroads the traffic which they enjoy, but it is true that the canals should and can be used to protect our merchants and shippers against unfair discrimination. This it has accomplished in the past, and for future protection the canals should be continued under State supervision.

In considering the decline of the commerce of the port of New York, it is well to understand that the harbor facilities of Philadelphia, Baltimore, Newport News, Boston and Montreal have been greatly improved, and it is not to be expected that, not-

withstanding anything that might be done to bring trade to our own port, there should be no increase in the business of these ports. Yet the fact is apparent that of the 59,000,000 bushels of wheat exported from these six ports in 1899, 25,000,000 bushels came to the port of New York; in 1898, of the 98,000,000 bushels, 49,000,000 bushels came to New York; in 1897, of the 66,000,000 bushels, 25,000,000 bushels came to New York; in 1896, 18,000,000 bushels out of a total of 46,000,000 bushels came to New York; and in 1895, 20,000,000 bushels out of a total of 35,000,000 bushels came here, showing an annual decrease in the percentage at the port of New York. This is also true of the shipments of flour. While the number of barrels shipped from these outports in 1894 and in 1899 was practically the same, the shipments from the port of New York have fallen off nearly two million barrels.

It is doubtful whether the inadequate canal facilities are entirely responsible for this condition of affairs. The terminal charges and dock facilities are not as desirable in New York as they are at the other ports, and in considering the question it is well to give due weight to these factors in the case. It is also well to understand that the numerous improvements suggested under the act of 1900 contemplate the abandonment of the old method of propelling the boats. New transportation facilities will have to grow and a considerable amount of money be invested before the canal upon any of the plans outlined under this act can be made effective. It is therefore possible that some years may elapse before New York would receive the full benefit of the proposed improvements.

I am, therefore, brought to this conclusion: First, that in the proposed improvement for 1,000-ton barges the advantages to be derived are not commensurate with the expense involved. That the purposes for which the canals should be maintained are more for protection against unfair discrimination than they are for actual use. If this be true, it would seem that the smallest expenditure would be ample and that the enlarged barge canal recommended should not be adopted. It might be possible, by lengthening the locks and by changes of a similar character that larger boats might be used and more expeditious locking secured, as recommended under the modified plan of 1895. If that course shall be adopted, it is understood that the estimate of $19,000,000 will not be sufficient, and perhaps several million dollars should be added to the estimate.

It is your province to thoroughly consider the various plans proposed. It seems to me, however, that there can be no reasonable argument advanced for the large canal as a competitor with the Canadian canals, because under the most favorable conditions we would still be as far from Liverpool, and the distance from the port of New York would still be several hundred miles further than from Montreal. We can discard that part of the proposition, therefore, and consider the canal question as one more local than international. The question, however, is one that should be submitted to the people, and where so large a proportion of the citi-

zens of the State desire affirmative action there would seem to be no excuse why the Legislature should delay submitting the matter for their approval or disapproval.

The figures which have been submitted show, first, that the cost as between the more expensive and the least expensive projects, for transportation, is a trifle, and the time consumed in transportation shows a difference of less than two days between the two. That the question of competition with the Canadian canals would still be unsolved, as even the large project would give a canal smaller than the Canadian canal. That our terminal charges would still be as large as at present, and that other legislation will be necessary in order to remove from the port of New York the disadvantages under which it labors, in order to restore to it some of its lost commerce.

I therefore recommend that the question of improving the canals along the line of the act of 1895 be submitted to the people at the coming election, in the belief that it will meet with greater approval, that the expenditure can be more easily met, and that it will serve all the purposes for which the canal was originally designed.

B. B. ODELL, Jr.

CANAL MAINTENANCE DURING 1901.

The maintenance of the works of the present canal has been provided for by many appropriations and special acts during the last session of the Legislature, and the designing and construction of these works which are of unusual extent and variety, have received the attention of the State Engineer during the past year.

Changes have been made in the specifications prescribing the methods of work, which have been brought to agree with the latest methods employed by engineers in the design and construction of works of similar importance. The preparation of these standard specifications has received the attention which the importance of the subject merits.

The great improvement during recent years in the manufacture of American Portland cement and the advantage and economy to be obtained by substituting concrete for the much more expensive cut stone masonry have been fully recognized, it being considered that the use of the best class of concrete instead of cut stone will give better results at less than half the cost.

A statement of the engineering expenses for the maintenance during the fiscal year and of the pending and completed contracts for the various works appears in Appendix A at 52 of this report, and is also presented in detail in appended reports of the division engineers at pp. 219, 256 and 322.

Face page 14.

FULTON COUNTY, N. Y.: GLOVERSVILLE AND MAYFIELD ROAD, No. 33.
Quarry of granitic rock 2 miles from center of road.
Improvement of road in progress by State Engineer in 1901.
Base, top and binder of this rock.

HIGHWAY IMPROVEMENTS.

The subject of highway improvement by State aid attracts the attention of the people of the State, and their interest is shown to be greatly enhanced as a result of the work which has been done by the State Engineer Department in building macadam roads in different portions of the State under the provisions of chapter 115, Laws of 1898.

Petitions have been received from 35 counties for 233 roads, having an estimated length of 1,040 miles.

Surveys have been made of 185 of these roads located in 32 counties, aggregating 624 miles in length, which are described as follows:

There have been built, or are now building, 51 of these macadam roads located in 19 counties, aggregating 134½ miles in length at an average actual cost of $7,955 per mile; also 5 earth roads located in Orange county, aggregating 33.61 miles in length at an average actual cost of $2,134 per mile. The details of these roads are shown on the accompanying tables.

Surveys, plans and estimates have been made and accepted and the counties' half of the estimated cost has been actually appropriated by the boards of supervisors for 46 macadam roads located in 12 counties, aggregating 121.66 miles in length at an average estimated cost of $9,011 per mile; also 4 earth roads located in Orange county, aggregating 20.32 miles in length at an average estimated cost of $2,293 per mile.

Surveys, plans and estimates have been made or are in progress for 79 roads located in 25 counties, aggregating 314 miles in measured length, which will be submitted to the boards of supervisors at their coming sessions.

Surveys are yet to be made for 76 roads located in 22 counties, aggregating 416 miles in estimated length.

Roads Completed During Each Calendar Year.

CALENDAR YEAR.	County.	Number of roads.	Miles completed.	Total miles.
1899	Columbia	1	1.25	
	Oneida	1	2.25	
	Schenectady	1	2.00	5.50
		3		
1900	Erie	2	7 99	
	Monroe	3	9.61	
	Onondaga	2	1.60	
	Rensselaer	1	1.00	
	Ulster	1	5.66	25.86
		9		
1901	Albany	1	3.41	
	Chemung	2	3.631	
	Erie	1	1.155	
	Herkimer	1	1.110	
	Monroe	1	1.304	
	Oneida	1	1.40	
	Rensselaer	2	4.18	
	Westchester	4	11.79	27.97
		13		
Total miles completed to December 31, 1901				59.33

One-half of the cost of the roads thus built has been, or will be, paid from the sum of $670,000, which is the total amount that has been appropriated by the State during the four years since the passage of the law, March 24, 1898.

The subject is shown in table herewith and presented in detail in the appended reports of the Division Engineers, pp. 195, 251 and 310.

Those roads which have been completed have given unqualified satisfaction to the people who have used them and have helped to pay for them, and in nearly every case the immediate result has been the presentation of petitions for the extension of the road so built.

During 1899 there was built in one of our counties a gravel road which has given entire satisfaction and which cost much less than a macadam road would have cost. There have since been many calls from different parts of the State for roads of this or a similar character, and it has been decided to recommend these cheaper roads where heavy traffic does not make it necesary to build the high-class and more costly macadam roads, and thus to enable those counties who have as yet made no petitions to avail themselves of the "Good Roads" Law.

IMPROVED ROADS WHICH ARE NOT MACADAM ROADS.

Improved roads are wanted by the people in all parts of the State, and the omission of the 24 counties to take action under the Higbie-Armstrong Law of 1898, has been because of the great cost of building the crushed stone macadam roads, which are usually meant when "good roads" are mentioned.

Some counties can afford to pay one-half the cost of the first-class crushed-rock roads which are built by State aid at $7,000 to $9,000 per mile, but many other counties want "improved" roads, which are neither so good nor so costly as the macadam roads.

The provisions of the Higbie-Armstrong Law are such that the State Engineer is enabled to select for the improvement of any highway, a telford, macadam or gravel roadway, or other suitable construction, taking into consideration the climate, soil and materials to be had in that vicinity, and the extent and nature of the traffic likely to be upon the highway, specifying in his judgment the kind of road which a wise economy demands.

(Section 4, chapter 115, Laws of 1898.) See p. 62.

Under this provision, the surveys and estimates which have been made during 1899, 1900 and 1901, have in every case, where the conditions make it desirable, provided for the use of local stone or local gravel; but the State Engineer now decides to carry this action still further and to make merely "improved" roads for such counties or towns as do not want macadam roads.

This will be done in such way that none of the work will have been wasted if it is later desired to form a good macadam road on the same highway.

The existing roadway will be properly cleared of sod and stones, and properly graded with the ditches and culverts necessary for perfect drainage, and the natural material forming the present road will be properly formed and "crowned" and rolled, as is now done to form a subgrade for a macadam road.

If the natural soil is light sand, as is often the case, this sand

will be covered with six inches of clay or shale, if such material is within reach, and the surface will then be rolled until it is hard and firm.

If the natural soil is argillaceous sand or soft clay or loam which make deep mud when wet, such material will be covered with gravel if it can be found in the vicinity and can be used without too great cost.

If the natural soil is a mixture of gravel and loam, as is frequently the case, this material itself will form a fair roadway when crowned and ditched and rolled.

In any such case, an "improved" road will thus be made which will be vastly better than any former condition of such a highway and which will drain itself much quicker, and be in every way much better, than the existing roadway. It will not be a macadam road,.but it will be an "improved" road and its cost will be less than one-third of the cost of a macadam road, or say, $2,000 to $3,000 per mile.

If the local authorities should later desire to make a macadam road on such an improved highway, the grading and ditching and forming which have been described will be so much work already done towards forming such a high-grade macadam road.

By this means it is hoped to enable many of the rural counties of the State to have the benefit of State aid for the improvement of their highways.

WIDE TIRES.

Chapter 155, Laws of 1899, empowers boards of supervisors to enact local laws regulating the width of tires used on vehicles built to carry a weight of 1,500 pounds or upwards, and to provide penaltes for the violation thereof.

Several counties have taken advantage of this law and have enacted local laws specifying the width of tires which may be used on various kinds of vehicles, and prescribing a penalty for the violation of the enactment, the fines collected being devoted to the highway fund of the town in which the offense is committed. Copies of some of these laws are given at page 70.

Face page 18.

WESTCHESTER COUNTY, N. Y.: WHITE PLAINS AND ARMONK ROAD, No. 36.
In progress of improvement by State Engineer in 1901.
Rolling the base course.
Base and top of local granitic rock: Top bound with equal mixture of screenings of local granitic rock and of Clinton-Point Hudson-River limestone.

As to the desirability of the use of wide tires there can be no question. The most casual observation will suffice to convince one of the damage which a heavily laden wagon equipped with the ordinary sharp, narrow tires will produce on any road. There is also another and perhaps even greater advantage to be gained by the use of wide tires, namely, the increased hauling capacity attained.

A very interesting bulletin (No. 12) has been issued by the United States Department of Agriculture, giving a synopsis of the laws of various States in the Union and in foreign countries in relation to the use of wide tires, together with detailed descriptions of thorough tests which have been made and the results thereof. These tests proved conclusively the advantages of wide tires to the general public as a road improver, and to the individual user as a money saver. It requires no complicated arithmetic to figure out the benefit derived from the use of a vehicle capable of carrying on macadam roads 2,500 pounds as against 2,000 pounds, on gravel roads 2,482 pounds as against 2,000 pounds, and on dry dirt roads 2,500 pounds as against 2,000 pounds; while on clay roads with deep mud slightly dry on top a large number of tests showed an average of 3,200 pounds for the wide-tired vehicles as against 2,000 pounds for the narrow-tired.

An instructive paper (Bulletin No. 39) issued by the Agricultural Experiment Station of the University of the State of Missouri, at Columbia, Mo., contains a very exhaustive discussion of the influence of the width of tires on draft of wagon, with details of tests in all descriptions of roads, on meadows, pastures, stubble and plowed lands, with cuts showing the roads as they appeared after the tests were made, and giving as a conclusion an advantage varying with different conditions to from 17 to 120 per cent. in favor of wide tires.

While the same local law may not be applicable to all parts of the State, the act which allows the supervisors of each county to make their own law, thus enabling the varying conditions

to be carefully studied and provided for and places it in the power of each county to take such action as may be deemed wise toward bringing into general use what is universally conceded to be one of the most effectual aids to good roads and a saving of labor and expense to their users.

TESTS OF ROAD MATERIAL.

It has been found desirable to make comparative tests of the wearing qualities of the various rocks found near proposed roads in different parts of the State in order to determine which of them are best adapted to the purpose. Much of the stone throughout New York State is entirely unsuited for permanent road building, some of the limestone being too soft for the purpose, while much of the sandstone is much too brittle and friable and has no binding properties. In order to compare the various rocks, this Department has found it most advantageous to obtain the co-operation of the engineering department of Columbia University, where there is installed a complete outfit of the latest improved devices for testing crushed stone by abrasion of the fragments and by cementation of the dust resulting therefrom.

William H. Burr, M. Am. Soc. C. E. and professor of civil engineering in Columbia University, has taken much interest in the subject and has given this Department the full benefit of this outfit, as well as of his personal supervision, and also of the services of Adolph Black, civil engineer, instructor, who has had direct charge of these tests, with the results which are here shown.

The apparatus and the methods which were used in making these tests are identical with those used in making similar tests for the Massachusetts Highway Commission, the results of which are published in the report of the commission for 1900.

Face page 20.

ALBANY COUNTY, N. Y.: DELAWARE TURNPIKE ROAD, NO. 7, SOUTH FROM ALBANY.
In progress by State Engineer on new line in 1901 (old line on right).
Base of Stony-Point Hudson-River limestone: Top of Rockland-Lake Hudson-River trap rock, bound with Bethlehem, Albany County, limestone screenings.

The stone to be tested consists of selected fragments each of which is nearly cubical in form, none having a less dimension than 1¼ inches nor a greater dimension than 2½ inches measured through the corners on the longest line of the fragment. All fragments are rejected which have thin sharp edges which will easily break off. Five kilograms or 11 pounds of these selected fragments are thoroughly cleaned, washed and dried before being tested. In making the test for abrasion the machine used is a modification of the original Deval machine, which was first exhibited at the Paris Exposition of 1878. The present machine consists of four hollow cast iron cylinders each 20 cm. (7.9 inches) in diameter and 34 cm. (13.4 inches) in depth. Each cylinder is closed at one end and has a tight-fitting iron cover for the other end. The four cylinders are fastened to a shaft so that the axis of each cylinder is at an angle of 30 degrees with the axis of the rotation of the shaft. The charge of stone for each cylinder is weighed with minute accuracy to be 5 kilograms or 11 pounds. The covers are secured to each cylinder, and the whole is then rotated at a uniform rate of about 2,000 revolutions per hour for five hours or until an automatic recorder shows 10,000 revolutions. By this means the fragments of stone within each cylinder are thrown back and forth and are abraded against the sides and ends of the cylinders and against each other, with the result of giving to each different set of samples precisely the same amount of abrasion. After 10,000 revolutions the machine is stopped, the cylinders are opened and the contents of each are placed on a sieve of 1-16-inch mesh. The material which passes through this sieve is put aside for the cementation test. The sieve and the remaining fragments of stone are then held under running water until all the adhering dust is washed off. The remaining fragments are then thoroughly dried and carefully weighed, and the difference between this weight and the original 5 kilograms or 11 pounds shows the amount worn off during the test.

The percentage which this 1-16-inch dust bears to the original weight may be taken as the basis of comparison, or the French coefficient of wear may be determined by the formula which is based upon the fact that only the best varieties of rock show a wear of less than 20 grammes per kilogram or 2 per cent. of the original weight. This formula is as follows:

$$\text{Coefficient of wear} = 20 \times \frac{20}{W} = \frac{400}{W}$$

in which W is the weight in grammes of dust less than 1-16-inch per kilogram or per 2.2 pounds of rock used.

The cementation test is then made from the material which has passed through the 1-16-inch mesh. This material is screened with a sieve having 100 meshes per inch, and the resulting dust is made into briquetts 25 mm. or .98 inch in diameter and the same in height by moistening the dust with distilled water, placing the moistened dust in a metal dye of the above named dimensions; a closely fitting plug is then inserted on top of the moist dust and subjected to a pressure of 100 kilograms per sq. cm., or 1,422 pounds per square inch. Five briquetts are usually made from each sample, and the briquetts are then allowed to dry in a temperature of 60 degrees to 70 degrees for about two weeks, A specially devised machine is then used to test the strength of these briquetts by automatically dropping a hammer weighing one kilogram or 2.2 pounds a distance of one cm. or .39 inch. This machine being a miniature automatic pile driver, which lifts the hammer exactly the distance for which it is set, records the number of blows and indicates when the bond of cementation is broken.

The result of these tests is given in each case as the average of the several tests made for each specimen.

For purposes of comparison these are followed by the results of similar tests made by the Massachusetts highway commission of ten specimens of diabase (trap) as published in their annual report for 1900.

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ALBANY COUNTY, N. Y.: DELAWARE TURNPIKE ROAD, NO 7, SOUTH FROM ALBANY.
In progress by State Engineer on new line, 1901.
Base of Stony-Point Hudson-River limestone: Top of Rockland-Lake Hudson-River trap rock, bound with Bethlehem, Albany County, limestone screenings.

Tests of Road Material.

LOCALITY OF QUARRY.	Name of rock.	Wear. Co-efficient.	Wear. Per cent.	Cementation value.	Where used.
Clinton Point, near Poughkeepsie	Gray limestone	13.80	2.90	39	Used for base of 9 miles of roads in Eastern New York, built by State in 1899 and 1900, and also for base and top of many roads in vicinity of New York city.
Little Falls, Herkimer Co., Moss Island, Mohawk River	Hornblendic gneiss	15.16	2.64	10	Used for base and top of 1 mile of Frankfort and Utica road, built by State in 1900.
Glacial drift field stone, near Rochester, Monroe Co.	Red sandstone	9.03	4.43	16	Used for base of Little Ridge road west from Rochester 6 miles, built by State during 1899 and 1900.
Glacial drift field stone, near Rochester, Monroe Co.	White sandstone	11.05	3.62	24	
Seneca Clark Quarry, 12 miles south of Syracuse, near Lafayette, Onondaga Co., N. Y.	Gray sandstone	5.97	6.69	68	
National Wall Plaster Co., Jamesville, Onondaga Co., N. Y.	Limestone	10.95	3.65	15	
Alvord Quarries, near east line of town of Onondaga, Onondaga Co.	Blue limestone	9.14	4.38	89	
Split Rock Quarries Solvay Process Co., town of Onondaga, also, Indian Quarries, on N. E. part Onondaga Reservation, also, Jamesville Quarries near Penitentiary of Onondaga Co., N. Y.	Gray limestone	6.20	6.45	22	Used for base of 2 miles of James st. and Cortland street roads, near Syracuse, built by State in 1899 and 1900.
Indian Quarries, overlying the grey, on N. E part Onondaga Reservation	Blue limestone	5.99	6.68	33	
Buffalo Cement Co Quarries, in north part of City of Buffalo	Buffalo Plains limestone, with little embedded flint	8.29	4.82	67	Used for base and top of 33 miles of 16-foot roadways in ten cities and towns of Western New York during years 1893 to 1900; used for base of 6 miles of State road near Buffalo.
	Buffalo Plains limestone, with much embedded flint.	9.66	4.14	94	
Bluestone Quarry, near Phœnecia, Ulster Co., N. Y.	Blue sandstone	11.17	3.58	39	Used for base and top of 10 miles of Ulster and Delaware road, built near Phœnecia by State in 1900 and 1901.
Water-worn stones from bed of Esopus Creek, near Phœnecia, Ulster Co., N. Y. (similar to the quarry stones)	Blue sandstone	10.42	3.84	11	
Smith & Post Quarry, West Catskill, N. Y.	Sandstone, Esopus grit	8.52	4.69	60	
Turtle Pond Quarry, Kaaterskill, N. Y.	Shaley gray New Scotland limestone	10.09	3.96	63	
Holdridge Quarry, Kaaterskill, N. Y.	Becraft reddish gray crystalline limestone	7.61	5.25	56	

LOCALITY OF QUARRY.	Name of rock.	Wear. Co-efficient.	Wear. Per cent.	Cementation value.	Where used.
LeRoy, Genesee Co., N. Y., N. B. Keeney & Son's Quarries	Gray limestone	10.87	3.68	21	Used during 1901 for base of 1 mile of Orchard Park road, Erie Co., and for base of 1 mile of Pittsford road, and of 1½ miles of Fairport road in Monroe Co., and for filler for several other roads built by State.
Ditto	Gray limestone	11.04	3.62	15	
Ditto	Gray limestone	10.70	3.74	21	
Perryville, Madison Co., N. Y., Cyrus Warlock's quarries, on Canastota branch of the Lehigh Valley R. R.	Gray limestone	7.99	5.00	24	Used during 1901 for base and top and filler of half mile of road built by State at Truxton, Cortl'd Co.
Plattsburgh, Clinton Co., N. Y., Moore's Quarry, north side of village	Blue limestone	6.87	5.82	11	Used during 1901 for base and top and filler of 1/6 mile of Plattsburgh and Keeseville road built by State.
Five miles south of Plattsburgh, N. Y., quarry on north bank of Salmon river	Gray limestone	10.94	3.66	25	Used during 1901 for base and top and filler of 2½ miles of Plattsburgh and Keeseville road built by State.
Rockland Lake, N. Y., quarries of Rockland Lake Trap Rock Co.—(Conklin & Foss (opposite Sing Sing, on the Hudson river	Diabase (trap) coarse	14 62	2.74	35	Used during 1900 and 1901 for top of 2 miles and for base and top of 1 mile of Loudonville road, built by State, north from Albany.
Six miles S. W. of Glens Falls, N. Y., Slade's Quarry—from north end of quarry	Gray and black granite	9.30	4.30	7	Used during 1901 for base of 3½ miles of Glens Falls and Saratoga road, built by State south from Glens Falls.
Ditto, from center of quarry.	Gray granite	10.88	3.68	8	Top of ditto.
New Jersey Rocks.					
Millington, N. J., quarries of Morris Co. Crushed Stone Co	Basalt (trap)	18.57	2.15	......	Used during 1895-1901 for 50 miles of roads in Morris, Somerset and Union counties, New Jersey.
Bound Brook, N. J., quarries of Bound Brook Crushed Stone Co	Basalt (trap)	19.27	2.08	....	Used for roads in vicinity of Bound Brook, Somerville and New Brunswick, New Jersey.
Westchester County, N. Y.					
On east side of Kensico reservoir at roadside	Gray quartzite	11.13	3 59	9	Used during 1900 and 1901 for base of 3½ miles of White Plains and Armonk road, built by State.
Near Elmsford, N. Y., spoil-bank of shaft No. 12 excavated from Croton Aqueduct tunnel in 1888	Quartzite	6.77	5.90	15	Used during 1900 and 1901 for base of Saw-mill River road, built by State.
One-half mile north of East View, N. Y., Rockefeller Quarry, at roadside	Dark gray granitic rock	10.06	3.98	10	Used during 1901 for base of roads north and south from Eastview, built by State.

LOCALITY OF QUARRY.	Name of rock.	WEAR.		Cementation value.	Where used.
		Co-efficient.	Per cent.		
Two miles west from Bedford, ledge at Light's farm.	Pink and gray gneiss	8.64	4.63	12	Used during 1901 for base of 2 miles of road between Mt. Kisco and Bedford, built by State.
Chemung County, N. Y. Well's Quarry, 3 miles west of Elmira, N. Y.	Chemung grit	5.82	6.88	24	Used during 1901 for base of 3¼ miles of the Southport road to the south boundary of New York State, built by State.

TEN RECORDS OF TESTS OF TRAP ROCK, FROM REPORT OF MASSACHUSETTS HIGHWAY COMMISSION, 1900.

LOCALITY OF QUARRY.	Name of rock.	WEAR.		Cementation value.	Where used.
		Co-efficient.	Per cent.		
Amherst, Mass	Diabase (trap)	20 33	1.97	62	
Beverly, Mass	Diabase (trap)	16.71	2.39	14	
Boundbrook, N. J	Basalt (trap)	18.61	2.15	16	
Byram Station, N. J	Basalt (trap)	26.93	1.49	81	
Great Notch, N. J	Diabase (trap)	18.59	2.15	36	
Rockland Lake, N. Y. (opposite Sing Sing)	Diabase coarse (trap)	17.79	2.25	13	
Lynn	Diabase (trap)	......	......	......	
Meriden, Conn	Diabase (trap)	15 49	2.58	28	
Milton, Mass	Diabase (trap)	22.77	1.75	34	
West Springfield, Mass	Diabase porphyry (trap)	22.14	1.81	17	
Millington, N. J	Trap	19 64	2.04	53	
Averages		19.91	2.06	30	

PRISON LABOR FOR HIGHWAY IMPROVEMENT.

There is a growing sentiment throughout the State that all prisoners confined in the county jail, as well as all convicts who are confined in the prisons of the State, can be profitably employed in different ways in improving the highways.

As regards county prisoners, this feeling has been strengthened by the success which has attended efforts made in that direction in several counties, and this work can be extended by using this unskilled labor in grading the roads preparatory to their final improvement under the provisions of the Good Roads Law. For the employment of the State prisoners, no better suggestion can now be offered than to repeat what was said on this subject in the last annual report of this Department.

The principal formation of trap-rock in New York State, exists in Rockland county just across the Hudson river from Sing Sing prison, where a large number of convicts are confined in idleness, which is injurious to them and expensive to the State. It would seem practicable that the State should opên a quarry in the trap-rock formation near Sing Sing, where the picturesque features of the Palisades should in no wise be affected by it, and should equip this quarry with stone-crushing machinery. The convicts could here be confined as securely as in Sing Sing, and the crushed rock delivered at the wharf on the Hudson river, or on cars on the railroad, at about one-third the price now charged by private quarries along the Hudson river in New Jersey. Contracts for highway improvement could be let with the stipulation that the contractor could obtain the necessary stone at a certain fixed price per cubic yard at the State wharf, where it could be loaded onto canal boats or cars for transportation to any part of the State.

For such localities as could only be reached by railroad transportation, special freight rates could doubtless be arranged with railroad companies, since railroads profit directly by the improvement in highways, all of which are direct tributaries to the railroads and bring to them business which is created by the existence of good highways.

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FULTON COUNTY, N. Y.: GLOVERSVILLE AND MAYFIELD ROAD, NO. 33.
As improved by State Engineer, 1901.
Base, top and screenings crushed from local granitic rock

The question of the profitable employment of convict labor in building roads has received much attention, and many discussions for and against it have been printed. Such an arrangement as is here suggested seems to avoid the objections, since the prisoners can be confined as closely as within the walls of Sing Sing prison, and when working will not compete in any way with organized labor.

The counties wishing to reduce the cost of improving their highways can employ upon the work of drainage and of grading, the prisoners confined in idleness in the county jails, which are now sought by the criminal class as a welcome retreat where they can be cared for at the cost of the taxpayers. Fifteen hundred men are thus confined, many of whom can be usefully employed in improving the highways.

These prisoners could be employed to prepare the roads so that the contract for macadamizing could be let at a less cost to contractors who have the road-building machinery necessary to go on and complete the work. Or the counties or towns could supply themselves with the needful outfit of steam rollers, wheeled scrapers, sprinklers, and spreader wagons and could take the contract for building and completing the road under the direction of the skilled roadbuilders of the State Engineer's Department.

No close estimate can be made as to the actual value of the services of such prisoners. Various plans have been tried in some counties of this State and in some other States with varied results. The reports from North Carolina indicate a large saving and good results.

In order to enable representatives of the various counties to discuss the subject of highway improvement by State aid, the State Engineer sent invitations to all of the counties of the State, with the result that a convention was held in the city of Albany on February 14 and 15, 1901, at which convention there were assembled 132 delegates from 39 counties.

In the circular calling the convention, the State Engineer specially requested that representatives should be sent who

should express the feeling of their counties whether for or against the improvement of highways by State aid. The meeting was a most successful one and resulted in the adoption of a resolution requesting the Legislature to appropriate one million dollars to carry out the provisions of the Higbie-Armstrong Law; also favoring the money system of highway taxes and the employment of convict labor.

The proceedings of this convention are published in full at pp. 76 to 86 of this report.

A similar convention will be held in Albany during January 28 and 29, 1902.

During the year the State Engineer and the Deputy State Engineer have made numerous speeches at various places in the State for the purpose of explaining the operations of the law of highway improvement by State aid.

It is recommended that the Legislature should enact a law enabling the State Engineer to close any road during the progress of its improvement and also a law providing for maintenance in explicit terms which will enable the highway commissioners to raise the money needed for such maintenance.

There are printed at pp. 62 to 67 of this report copies of the Highway Improvement Law, and of its amendment regarding maintenance; also a copy of the Wide Tire Law, and a presentation of the facts regarding the effects of the use of wide tires at pp. 67 and 70.

The State Engineer recommends that the Legislature shall appropriate not less than $750,000 for highway improvement in order that the roads may be improved for which plans and estimates have already been approved by the various counties of the State.

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ULSTER COUNTY, N. Y.: ULSTER AND DELAWARE ROAD, NO. 31.
Along Esopus Creek valley, near Pine Hill.
In progress of improvement by State Engineer in 1901.
Base and top of local "bluestone" (sandstone), bound with "bluestone" screenings.
Road built by Town Board as Contractors.

SUGGESTED BONDING SYSTEM.

While great progress has been made in the work of improving our public highways, it has been suggested that some method should now be adopted by which a system could be put in operation for the purpose of improving within a very few years such a part of the principal roads in the State as would be of most benefit to the greatest number of citizens, and that this improvement should be conducted in a more expeditious manner than is now possible. To do this would require a larger annual expenditure on the part of the State than has yet been made, and if paid at one time would impose a larger burden upon the State than it would be wise to inflict in one, two or even five years. The work which is being done is not only for the present, but for all time; and many, therefore, advocate an issue of State bonds for the purpose of improving our public highways under the provisions of the present State Aid Act, claiming that this would fulfill two important requirements, first, there would be immediately available a sufficient sum to provide for the improvement within the next three or four years of a large proportion of the principal roads which are worthy of improvement, and, secondly, it would distribute the cost of such improvement over a term of years, making the annual payment so small as to be scarcely perceptible and allowing those who would benefit by the work in the future an opportunity to help pay for its construction.

The funds derived from the sale of these bonds could be used for the purpose of paying the total cost of improvement of highways and the counties' share could be returned to the State in payments extending over a term of years equal to that over which the bonds extended.

With these points in view the suggestion has been made that the State of New York should issue bonds for $10,000,000 to be expended in the improvement of public highways in accordance with the provisions of the so-called State Aid Act, namely, chapter 115, Laws of 1898, these bonds to be payable at the expiration of seventeen years, bearing 3 per cent. interest, and conditioned

upon an equal annual payment which would meet both principal and interest at the end of the seventeen-year period. The money raised by these bonds, or so much thereof as might be necessary, would be immediately available and the improvement of public highways in the State could be carried on in a very expeditious manner and one-half of the cost could be repaid to the State by the counties, making a total net expenditure by the State at large of only $5,000,000.

The average annual payment which would be required to retire such a ten million bond issue, both principal and interest, would be about $760,000, being a State tax of not to exceed 6 cents per $1,000 based on present conditions, and assuming that each county received its pro rata share, and a county tax of not to exceed 17 cents per $1,000, for the above period of 17 years.

With this amount of money available the work of improving our public highways could be taken up in a most advantageous and systematic manner; and it is claimed that a system of roads somewhat as shown on the map hereto appended would prove of incalculable value to every citizen of the State, combining as it does a line of continuous roads connecting the extreme ends of the State and also a network of roads connecting many of the county seats of the several counties. It is not claimed the roads as shown on the map are those most needed at the beginning, but the map is intended to show what could be accomplished in case the citizens of the State should look upon this project favorably, leaving the exact location in each county to be determined after consultation with its citizens.

This plan would meet the wishes of many advocates, while many others claim that in these days of easy and quick communication between distant points by means of steam and electricity there is not the same necessity for long and continuous highways alone, as was the case in the past when the only means of communication was by way of boat and roads. Radiating from each of the principal cities and villages and acting as the main arteries through which comes a large proportion of the travel of each separate county are usually a few principal highways which

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ULSTER COUNTY, N. Y : ULSTER AND DELAWARE ROAD, NO. 16.
Along Esopus Creek valley, near Phoenecia.
As improved by State Engineer in 1900, showing sprinkler wetting front wheel of roller.
Base and top of local "bluestone" (sandstone), bound with "bluestone" screenings

in turn are tapped at frequent intervals by cross roads. A network of roads connecting all of the county seats of the several counties (with the exception of those localities where communication is rendered extremely difficult or impossible by reason of forests or mountains, or where the travel is so limited as not to warrant the necessary improvement) would undoubtedly accommodate nine-tenths of the travel and would accomplish the required result, namely, the greatest benefit to the greatest number.

The roads as shown on the map which accompanies this report, with such modifications, of course, as would be required after a careful study of each locality, should be first constructed as speedily as possible. A study of the map will show, also, that in improving the roads connecting the county seats long continuous highways connecting the extreme portions of the State would be formed at the same time, as well as continuous roads crossing the State both at right angles and obliquely.

An expenditure of $10,000,000 would construct upwards of 1,250 miles of improved macadam road. Following along those counties which have thus far filed petitions for the largest amount of improved roads, it would seem that the first work should be taken up by connecting the counties running through the eastern, central and southern portions of the State. This would naturally form a continuous road from New York city, by way of Albany, to Buffalo; from Albany to Rouses Point; and from Nyack in Rockland county through the southern tier of counties to Mayville in Chautauqua county, aggregating altogether about 1,090 miles. These roads could with proper management be economically and successfully constructed within three or four years and the improvement of the remaining lateral roads connecting the county seats as shown on the map could then be taken up. Out of the ten million dollar fund there would be left sufficient for the improvement of about 160 miles of these lateral roads, which, added to the 175 miles of improved roads already completed and in process of construction and for which funds have been provided, and which would be utilized in

forming these lateral roads, would make a total of about 1,425 miles, or about one-half of the entire mileage as shown on the map.

This would permit the construction of one-half of the roads shown on the map within three or four years from the time the money would be available and the balance could be provided for as public sentiment called for it.

The possible location of the roads to be improved under this plan would be as follows: Beginning near the New Jersey State line in the county of Rockland and following through that county and Orange county to Newburgh; thence running westerly through the county of Sullivan, which is a section visited by many persons during the summer months, it being one of the health resorts of the State; passing on through Deposit on the Delaware river in Delaware county westward to Binghamton, Owego, Elmira, Corning and Bath, with roads diverging from Binghamton to Auburn and from Auburn on to Lyons and Rochester running obliquely in a northwesterly direction. From Elmira a branch road passes through Watkins at the head of Seneca lake, and continuing westward from Bath passes through Belmont in Allegany county and through the center of Cattaraugus county to Little Valley, its county seat; it then continues westerly to Mayville with a loop around Chautauqua lake, taking in the city of Jamestown. From Binghamton to Bath this road passes through a wide and fertile valley which is occupied at different points by the Susquehanna, Chemung and Canisteo rivers.

From Elmira a road passes in a northerly direction bearing somewhat to the westward in nearly a straight line to Rochester, passing through Watkins, Penn Yan and Canandaigua; or, the road running in a northwesterly direction from Bath to Geneseo, passing through Batavia, Lockport and thence to Buffalo, could be used if desired. This last line from Bath to Lockport or Buffalo is one of unusually easy grades, and through a very rich section of farming country.

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WESTCHESTER COUNTY, N Y.: MAMARONECK-WHITE PLAINS ROAD NO. 19.

As improved by State Engineer, 1901.

Base of local gneiss: Top of Meriden, Connecticut, trap rock, bound with Tomkin's-Cove Hudson-River limestone screenings.

From Bath westerly to Belmont the road crosses the divide between the Canisteo river and the Genesee river; again from Belmont to Little Valley in Cattaraugus county a divide between the Genesee river and the Allegany river is crossed; and from Little Valley westward to the northwestern end of Chautauqua lake the road passes from the valley of the Allegany river to the divide between the waters of Lake Erie and the Mississippi river, the loop continuing around Chautauqua lake to the city of Jamestown. This section is very delightful and is one much appreciated by persons seeking summer homes and outings and has a national reputation.

Another road starts at Kingston and running a little northwest follows the Esopus creek to the headwaters of the Delaware river, from whence it continues in the same direction to Norwich in Chenango county. If desired, this road could be diverted to a northerly direction from Delhi to Cooperstown, at the foot of Otsego lake, the home of Fenimore Cooper, and one of the many beautiful summer resorts of the State, and from thence northwesterly to Canandaraga lake (or Schuyler lake), at the head of which is located Richfield Springs, one of the summer and health resorts, and from Richfield Springs the road could run northwesterly to Syracuse or more northerly to Utica, as may be desired.

From Norwich the road beginning at Kingston passes through Cortland and continues westerly through Ithaca at the head of Cayuga lake and so on to Watkins; thence either westerly to Mayville or northwesterly to Rochester, as heretofore described. From Cortland a branch road leads in a northwesterly direction to Auburn, thence to Lyons and Rochester and so on westward by way of Albion and Lockport to Niagara Falls, Tonawanda and Buffalo.

A study of the map shows a direct line from Little Valley to Buffalo, and also a direct line from Mayville to Buffalo.

Starting in Westchester county at White Plains a road passes up the east side of the Hudson river through the counties of

Westchester, Putnam and Dutchess to a point opposite Kingston, passing through the county seats of the last three counties; thence to Kingston, or if preferred, from Carmel to Newburgh, and thence up the west side of the Hudson river through Kingston to Albany and Troy, with a branch line from a point opposite Catskill through the city of Hudson to New Lebanon and the State line of Massachusetts (being the northeast corner of Columbia county), at which point the road joins the improved State roads of Massachusetts leading to the city of Pittsfield and so on through that State, a branch line from this point also running in a northwesterly direction to the city of Troy.

From Albany or Troy a road passes through Schenectady, Amsterdam and Fonda, with a branch road from Fonda through Johnstown and Gloversville to Lake Pleasant. Returning to Fonda, a road continues west from that point through Little Falls in Herkimer county, Utica, Rome, Oneida and so on to Syracuse, with a branch road from Rome, passing through Boonville and Lowville to Watertown and thence to Alexandria Bay. Starting from Syracuse one road passes northwest to Oswego while another from Syracuse runs almost due north to Brewerton, Pulaski, Watertown and so on to Alexandria Bay. Continuing westward from Syracuse the road would again lead through Auburn, Lyons, Rochester, etc., to Niagara Falls and Buffalo as described over another line.

A road is also shown running from Watertown northeasterly through Philadelphia and Antwerp to Canton, with a branch road from Canton to Ogdensburg; from Canton easterly to Malone and Plattsburg; thence south through Elizabethtown, the county seat of Essex county; thence almost due south, through the valleys of the Bouquet and Schroon rivers, to Schroon lake; thence along the shores of that lake and through the valley of Schroon river to Warrensburg; thence on to Caldwell, at the head of Lake George; from there to Glens Falls and Greenwich, in Washington county, and on to Troy.

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WESTCHESTER COUNTY, N. Y.. ELMSFORD AND EAST VIEW ROAD, NO. 34.
As in progress of improvement by State Engineer in 1901
Base of local gneiss: Top of Rockland-Lake Hudson-River trap rock, bound with Clinton-Point Hudson-River limestone screenings

Repairing Ruts made by Narrow-tired Wagons, October 22, 1901.

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Showing Result of Repairs, between crosses, October 25, 1901.
Maintenance by Highway Commissioner.

MONROE COUNTY, N. Y.: EAST AVENUE ROAD, NO. 5, EASTWARD FROM ROCHESTER, N. Y.

Improved by State Engineer in 1900: Base of local limestone.
Top of Hudson-River trap rock, bound with screenings of local, Buffalo and Tomkin's-Cove limestones.

From Glens Falls a branch road leads southerly to Saratoga Springs, Ballston Spa, and Amsterdam, there joining the other system. The road taking in the belt of northern New York as described from Watertown to Saratoga Springs, together with a comparatively direct line leading from Lowville almost due west to Crown Point, passing through Lewis, Herkimer, Hamilton and Essex counties to Lake Champlain, embraces all of the varieties of beautiful scenery for which this state is noted, from that of the Thousand Islands in the St. Lawrence river to that of the North Woods and the Adirondack region as well as the beauties of Lake Champlain and Lake George.

This suggested improvement as shown in this way, and the effect of issuing bonds of the State for ten million dollars as herein described, is outlined for the purpose of acquainting the citizens of this State with the possibilities of what can be done if after deliberate consideration such a system is deemed advisable.

CEMENT TESTING FOR STATE AND MUNICIPAL WORKS.

All hydraulic cement intended for use in the masonry of the various State works has been tested in the laboratory of this Department, and no cement is used which does not meet the requirements. The effect of these tests is not only to prevent the use of poor cement but also to induce sending only the best grades to the State works, where it is known that the cement will be subjected to tests provided in the following extract from the 1900 standard specifications of this Department.

It is intended to raise the grade of these requirements during the coming year in order to keep up with the improved methods and products of American manufacturers of Portland cements.

Requirements Hydraulic cement. American Portland cement or American Natural cement, as may be specified, shall be used and shall be of a brand known by prior use on extensive works to be of the best quality. Any cement not so known may be declined without testing.

Storing. Provision shall be made by the contractor for storing cement in a dry place and delivery shall not be made until the State Engineer has been notified to inspect the cement and to take samples for which all facilities shall be offered by the contractor. The contractor shall replace at his own cost any cement which may be damaged while stored.

Samples. Samples will be taken by the Engineer, at once on delivery, from every tenth barrel or the equivalent of the tenth barrel if the cement is packed in sacks, and will be numbered consecutively throughout the progress of the work; each separate sample shall fill a three-inch cubical box, and each lot of samples shall be forwarded by express to Albany for separate tests, the results of which may be expected in ten days.

Tests. These tests will follow the practice recommended by the American Society of Civil Engineers and will be: 1st, for fineness; 2d, for soundness; 3d, for time of initial set; 4th, for tensile strength; 5th, for composition by chemical tests.

Required fineness. Cement shall be ground to such fineness that 95 per cent. by weight will pass through a standard sieve of 2,500 meshes per square inch, and 90 per cent. by weight will pass through a standard sieve of 10,000 meshes per square inch.

Soundness. The cement shall endure the hot water test at 125 degrees Fah. for 24 hours without cracking or blowing.

Chemical tests. The State Engineer may cause chemical tests of cement to be made, and may reject any cement which, in his judgment, is not suited to the purpose.

Initial set. Neat cement shall not set to support one-quarter pound weight on one-twelfth inch wire in less than 15 minutes for Natural cement and 25 minutes for Portland cement.

Required strength—American Portland cement. Briquettes of neat cement mixed 3 minutes, put in the moulds with thumbs and trowel, and kept at a temperature of 65 to 70 degrees for 1 day in moist air and 6 days in water shall show a least average tensile strength of 400 pounds per square inch.

Briquettes of three parts by weight of standard crushed quartz and one part by weight of Portland cement mixed in the same manner and kept 7 days under the same conditions shall show a least average tensile strength of 125 pounds per square inch.

Briquettes of three parts by weight of standard crushed quartz and one part by weight of Portland cement, mixed in the same manner and kept 28 days under the same conditions, shall show a least average tensile strength of 220 pounds per square inch.

Required strength—American natural cement. Briquettes of neat natural cement mixed 3 minutes, put in the moulds with thumbs and trowel and kept at a temperature of 65 to 70 degrees for 2 hours in moist air and 22 hours in water, shall show a least average tensile strength of 60 pounds per square inch.

Briquettes of natural cement and standard crushed quartz in equal parts, by weight, mixed and handled in the same manner and kept at the same temperature for 1 day in moist air and 6 days in water shall show a least average tensile strength of 65 pounds per square inch.

Briquettes similar to those last described and kept 28 days under the same conditions, shall show a least average tensile strength of 150 pounds per square inch.

Standard crushed quartz. The standard crushed quartz used in the tests shall pass a sieve of 400 meshes per square inch, and shall stop on a sieve of 900 meshes per square inch.

The sand which is to be used on the works is also examined and tested, as provided in the following extract from the 1900 standard specifications of this Department:

SAND. Sand used for mortar shall be of the best quality available and shall be of the cleanest and sharpest found in the vicinity of the work.

Samples. The contractor shall inform the State Engineer, as soon as the contract is awarded, what sand is proposed to be used, and samples of this sand will be obtained by the Engineer and forwarded to Albany.

Tests. These samples will be examined and tested at the cement testing laboratory at Albany and if found to contain an injurious amount of loam, or silt, or material that is friable or soluble, the contractor will be required to wash the sand before it is brought on the work.

Washing and clearing. It will be the duty of the Engineer in charge to see that the soil overlying the sand bank is cleared away so that no soil shall slide or wash into the sand during its use, and special attention will be given during the progress of the work to see that dirty sand shall not be used in making mortar.

Notice has been given in the engineering publications that the municipal officials of New York State can also have the benefit of these facilities, and that all city and county engineers can have tests made of any cement for use in municipal work and that the results of such tests will be promptly furnished under the seal of the State Engineer, free of all charges of any kind. This system is calculated to benefit the public works of cities throughout the State.

In addition to the specified tests, there have also been made during the year special tests with a view to determining the effect of the use of brine to retard freezing. These tests were made by forming blocks of concrete of the materials actually in and upon certain works and by using various proportions of salt in the water in which it was mixed; the blocks were then put out of doors and allowed to freeze and to thaw as in the actual work.

A detailed report of the operations of the cement-testing laboratory are given in the appended report of the engineer in charge on pp. 107-111.

COURT OF CLAIMS SURVEYS.

During the fiscal year there have been made surveys of the localities along the canals where claims have been made for damages alleged to have been caused by the canal and its works. Surveys, maps and photographs have been made and presented in the Court of Claims by engineers of this Department, and have resulted in saving to the State much money. Detailed description of this work will be found in the appended reports of the engineers on pp. 229, 272, 304 and 331.

It is recommended that the Legislature appropriate $15,000 for the continuation of this work.

OYSTER-BED SURVEYS.

The work of surveying and mapping lands under water for shellfish culture, and the preparation of necessary papers therefor, has been under the direction of this Department and of Shellfish Commissioner Hon. B. F. Wood. This has been done in continuation and pursuance of the oyster land surveys initiated by Hon. Eugene Blackford in 1887 and continued by successive Shellfish Commissioners to the present time. The effect has been to increase and extend the industry and to bring new lands into use and to increase the supply of oysters.

Details of this work are given in the appended report of the Surveyor of Oyster Lands on p. 114.

LAND BUREAU.

The Land Bureau of this Department has in charge the sale of State lands under water and the custody and care of the records of ancient surveys.

In research connected with the operations of this Department during the past year, it has been found that the files of the State did not contain many important ancient maps which are known to be in existence. A number of these valuable maps have been obtained from their present owners and facsimile certified copies have been made and filed.

An important addition has been made to the files of this Department by H. E. Pierrepont, Esq., of Brooklyn, who has presented to the State a collection of ancient and valuable maps. Sixteen are maps which were engraved and published for H. B. Pierrepont between 1797 and 1805, each showing a township in the northern part of the State; two show tracts of land and three are published maps of northern New York which are dated from 1795 to 1812 and show roads and boundaries; one is dated 1811 and shows the line and profile of the then proposed "Canal from Lake Erie to Hudson's River."

It is intended to make other valuable additions of this kind to the records of the State, as well as to provide for the better care and preservation of these records.

The report of the clerk of the Land Bureau giving in detail the operations during the past year, is appended at p. 116.

BUREAU OF BRIDGE DESIGNING AND INSPECTION.

The designing and inspection of the many bridges (about 800 in all) which the State is obliged to build and maintain across the canals constitute an important part of the duties of the State Engineer Department. During recent years there has been a growing demand for lift-bridges in the various cities, and these structures are of necessity much more expensive and intricate than the fixed bridges which they are designed to replace.

Previous to 1899 plans for the bridges to be constructed by the State were prepared by different engineering and bridge contracting firms. In 1899 the State Engineer decided that it was in the interest of the Department to have uniformity in the designs and a thorough familiarity with them directly in this Department and the State Engineer therefore favored the enactment of chapter 476 of the Laws of 1899 providing for the appointment by the State Engineer of a bridge designer and inspector and the necessary assistants.

This bureau has been in existence since July 24, 1899, and has been under the constant observation of the State Engineer. The results have been most satisfactory. The operations of the bureau are detailed in the report of the chief bridge designer appended at p. 119.

SURVEY OF THE STATE IN CO-OPERATION WITH THE UNITED STATES GEOLOGICAL SURVEY.

This work of co-operation was begun in 1892 and has since been continued by annual appropriations by the State, for the payment of one-half of the cost of the field work of the survey, the last being for $20,000.

Close attention has been given and close examination made of the merits of this system of co-operation and of the character of the work which is done under it, and it is found that the State is getting a fine class of work at a comparatively low cost. It is found that the maps produced are of great value to the State in many ways; especially in connection with the work of

highway improvement in different parts of the State and with the work of the Forest Preserve Board in the portion covered by the maps in the examination of water supplies for existing and proposed canals and for the great cities. A proof of each sheet is sent to this office from Washington for examination and approval before being finally published, and in this way judgment is made as to the character of the work and in some cases valuable additions are thus made.

The maps are published on a scale of about one inch to the mile, in sheets of which about 244 will cover the whole State; each sheet showing about twelve miles east to west by eighteen miles north to south. One hundred and six of these sheets have been completed and published and are for sale by the United States Geological Survey at the nominal price of five cents each; the engraving and publishing being done entirely at the expense of the United States Government. Thirty-two sheets are mapped and in the hands of the engravers; fourteen are surveyed and are in the hands of the draughtsmen. Of the remaining ninety-two which are required to cover the entire State, sixty have been triangulated and are ready to be surveyed.

The operations are detailed in the portion of this report at pp. 127 to 186 and the statement of Hon. Charles D. Walcott, Director of the United States Geological Survey, is appended on p. 125.

It is recommended to the Legislature that this co-operation of the State with the United States be continued, and that an appropriation of $30,000 be made therefor.

SHINNECOCK AND PECONIC CANAL.

This canal was excavated by the State, 1884 to 1890, for the purpose of connecting the tidal waters of Great Peconic bay with the non-tidal waters of Shinnecock bay, by cutting through the narrow neck at Canoe place. The result of the opening of this canal which was 4,000 feet long, 58 feet wide, and 4½ feet deep at low-tide, was to lower the level of Shinnecock bay and to erode the sand forming the banks and bottom of the canal

by the strong tidal currents passing through it. A swing bridge was built to carry the highway across the canal and jetties were built to protect the entrance into Peconic bay.

To restore the high level of Shinnecock bay and to check these strong tidal currents in the canal, automatic tide-gates were built by the State in 1896. To construct these gates, a system of piles was driven, upon which was placed a platform of natural untreated plank supporting five pairs of tide-gates placed side by side; the total width of the opening thus spanned being 98 feet, and the navigable opening being 28 feet in the clear, with 5 feet depth at low water on mitre-sill. The details of this work are fully shown, with many photographs, in the report of the State Engineer for 1896 at pages 29 to 33.

In making repairs to these gates and their supporting platform and timbers during the present year, it was found that the timbers had been entirely destroyed by the toredo, which is active in these waters, and also that the plank platform had been freely undermined. It therefore became necessary to either abandon the works upon which $195,500 had been expended since 1884, or to rebuild them in a thorough manner. To do this, it was necessary to place two coffer-dams across the canal and to build a concrete wall 10 feet deep below canal bottom with triple-lap sheet piles 20 feet deep to prevent undermining, and to build a concrete platform 3 feet thick and 22 feet wide, resting upon the tops of the piles which were embedded in the concrete; upon this to rebuild a framework and mitre-sills supporting the tide-gates with creosoted timber, and to replace the tide-gates in good working order. For this there was available $30,000, which was appropriated by chapter 419 of Laws of 1900, and which is sufficient.

This work is in progress at the end of the fiscal year and will be completed by the end of the calendar year.

BOUNDARY LINES OF THE STATE.

A triennial examination of the boundary lines of the State is required by chapter 678, Laws of 1892. The total length of the State boundary line is 1,416 miles, comprised as follows:

Canada line, 431 miles; Vermont line, 171 miles; Massachusetts line, 50½ miles; Connecticut line, to Long Island Sound, 81 miles; along the ocean around Long Island to the New Jersey shore, 246 miles; New Jersey line, 92½ miles; Pennsylvania line, 344 miles to the beginning of the Canada line in the middle of Lake Erie.

These boundaries are fixed by accepted agreements and are marked by natural water courses or by monuments as here described.

NEW YORK AND CANADA.

The boundary line between the State of New York and the Dominion of Canada runs through Lake Erie about 50 miles to the head of the Niagara river; through the Niagara river about 34 miles to Lake Ontario; through Lake Ontario about 175 miles to the head of the St. Lawrence river; thence northeasterly through the St. Lawrence river about 108 miles to a point 151 feet north of latitude 45 on the bank of the St. Lawrence river, which thus far is the boundary between the State of New York and the Province of Ontario; thence easterly 64 1-3 miles to a point on the Richelieu river, at the outlet of Lake Champlain, 4,200 feet north of latitude 45, which last section is the boundary between the State of New York and the Province of Quebec. The last-described portion of the line from the St. Lawrence river to the outlet of Lake Champlain was intended to follow the forty-fifth parallel. It was so mentioned in 1606 in a patent by King James First, describing this as the northern limit of certain territory, a part of which afterwards became New York State. By a proclamation of October 7, 1763, latitude 45 was also fixed as the boundary between the Province of Quebec and New York, and this was confirmed in council, August 12, 1768. This line was surveyed by Valentine and Collins in 1773 and 1774, who endeavored to run the forty-fifth parallel, but failed to do it accurately.

By the treaty of Paris, 1783, the forty-fifth parallel was again recognized as the northern boundary of this part of the State of New York.

By the treaty of Ghent, December 24, 1814, the same line was recognized as the boundary and its resurvey was provided for, and this was done by an international commission in 1818-1819. It was then found that the line of 1773-1774 did not follow the forty-fifth parallel, but was 151 feet north of it at the St. Lawrence river. It crossed the parallel to the southward, 4 miles east of the St. Lawrence river, running 2,506 feet south at 17½ miles east of the St. Lawrence river, and again crossing the parallel to the northward at 35 miles east of the St. Lawrence river, was 4,200 feet north of it at the outlet of Lake Champlain.

This is well shown on map accompanying Report of the State Engineer and Surveyor of New York for 1890, page 412.

Meantime the United States had begun the construction of Fort Montgomery at a site on the west side of the Richelieu river, 2,000 to 3,000 feet north of the forty-fifth parallel. This was made the most elaborate fortification on the northern frontier, being founded on piles and formed of two tiers of casements and a barbette tier, and was originally intended to mount 300 guns. This fortification would be thrown into Canadian territory if the forty-fifth parallel was adopted, as provided by the 1814 treaty of Ghent. By the treaty of Washington of 1842 the old line of Collins and Valentine, as run in 1773-1774, was adopted instead of the forty-fifth parallel, and this was retraced, established and monumented by an international commission in 1846 and 1847. It was marked by two stones, near the Richelieu river, one stone on the banks of the St. Lawrence river and 127 cast iron monuments set irregularly on the intervening 64 1-3 miles. The cast iron monuments were fragile and were insecurely set, and 69 of them now need replacing or resetting.

The entire line needs to be re-run and re-marked, as is shown in detail at pp. 195 to 224 of the Report of this Department for 1900, and the matter is under advisement with the Dominion Government.

NEW YORK AND VERMONT.

The boundary line between the States of New York and Vermont was originally established by commissioners of both States, whose report was submitted to the Legislature of each State in January, 1814. It was then marked by 33 marble monuments, the general condition of which is bad, as stated in the letter to the Governor of Vermont at page 225 of the Report for 1900.

For details as to the condition, see Report of State Engineer and Surveyor of New York for the year 1899, pp. 135 to 144.

NEW YORK AND MASSACHUSETTS.

The New York and Massachustees line was originally determined by commissioners appointed by Congress in 1787, and was marked by stone heaps, stakes and crosses cut in rocks. It was re-established in 1897, 1898 and 1899 by officers of the State of New York and of the Commonwealth of Massachusetts, and during these years was marked by 121 monuments, of which number, 83 are granite and 38 iron.

A full description of the re-establishing of this line and of the condition of its monuments is given in the Report of the State Engineer and Surveyor of New York for 1899, pp. 195 to 277.

NEW YORK AND CONNECTICUT.

The New York and Connecticut line was disputed for nearly 200 years until 1860, when it was established by a commission representing the State of New York. It was then marked by 100 monuments of marble and of iron, the condition of which was found to be good by an examination made during October, 1900, by a representative of this Department.

See Reports of State Engineer and Surveyor of New York for 1896, pp. 420-443, and for 1900, pp. 227-252.

NEW YORK AND NEW JERSEY.

The portion of the boundary line lying generally through New York bay and the Hudson river, 25 miles, is marked by ranges along the shores of the river on various landmarks and crosses

cut in the rock; all of which were established by commissioners of both States in 1891 and which have not since been examined. Full details are given in the reports of the New Jersey boundary commission of 1888 and 1891.

The portion lying across lands under water in Kill von Kull and Arthur Kill, about 18 miles, was established by commissioners of both States in 1888 and was then marked by 56 range monuments, most of which are in good condition. See Report of State Engineer and Surveyor of New York for 1900 pp. 253-254.

The portion of the line crossing land under water in Raritan bay, about 16 miles, was established by commissioners of both States in 1887 and was then marked by 8 buoys and 3 range monuments. The buoys are lost, but the monuments are in good condition. See Report of State Engineer and Surveyor of New York for 1900, pp. 254-263.

The portion of the line from the Hudson river to the Delaware river, 48½ miles, was established by commissioners of both States in 1774 and was then marked by 48 sandstone monuments; it was re-run by commissioners of both States in 1884 and 1885, and was then marked by 120 granite monuments, the condition of which is good and is fully described in Report of State Engineer and Surveyor of New York for the year 1899, pp. 145 to 193.

NEW YORK AND PENNSYLVANIA.

The New York and Pennsylvania line was originally established by commissioners of both States in 1774, 1776 and 1787, and was then marked from the Delaware river at forty-second parallel of north latitude to the shore of Lake Erie by about 250 monuments. The old line was re-run under the direction of commissioners of both States in 1876 to 1885, and was marked by 570 new granite monuments, the general condition of which is found to be good by an examination made during 1900 by a representative of this Department.

See Report of State Engineer and Surveyor of New York for 1900, pp. 264-279.

ST. LAWRENCE COUNTY LINE.

The lack of a definite location of the southern and a part of the southwestern boundary of St. Lawrence county has been and now is the cause of many disputes, and it is much desired by the residents of this region that this line, which is a difficult one, should be located, established and monumented in a manner similar to the county lines above described.

This will require that preliminary surveys be made of the two present locations of the line, with investigations of the various authorities for each of these lines, and with a final survey of the correct one.

It is recommended that the Legislature make an appropriation of $40,000 for this object.

LEVELS.

Inquiries are frequently made by civil engineers throughout the State for accurate bench-marks which may be used as starting points for local surveys. Lines of more or less accurate levels have been run during past years in connection with the various surveys made by the U. S. Coast Survey, the U. S. Corps of Engineers Lake Survey, the U. S. Geological Survey, the U. S. Deep Waterway Commission and the State Engineer's Department, and the various results have been publishd in different ways.

During 1901 connecting lines of levels have been run by engineers of this Department having had special experience in work of this character and using approved instruments, rods and methods for accurate results.

These, taken in connection with the U. S. Deep Waterway levels of 1898-9, and with the levels of the Barge Canal Survey of 1901, give accurate bench-marks on all lock-sills, lock-copings and spillway crests from Greenbush, on the Hudson river, to Lake Erie at Buffalo, to Lake Ontario at Oswego and to Lake Champlain at Whitehall. The results are here given at pages 617 to 711.

MEASUREMENT OF THE VOLUME OF STREAMS AND FLOW OF WATER IN THE STATE OF NEW YORK.

The State Engineer and Surveyor receives many requests for information on the above subject, which becomes more important with the growing demand for various water supplies for the great cities and with the increasing desire to develop the many water powers throughout the State. Having in view these facts, the State Engineer, during the 1900 session of the Legislature, favored the enactment of the following quoted law:

> *The People of the State of New York, represented in Senate and Assembly, do enact as follows:*
>
> The treasurer shall pay, on the warrant of the Comptroller, for the State Engineer and Surveyor, one thousand dollars to be used with the United States Geological Survey in hydrographic work connected with the measurements of the volume of streams and flow of water in the State of New York.

This act became a law April 13, 1900, and the results were embodied in the State Engineer's Report for 1900, pp. 309-429, and were also published separately. The public approval was so general and there were so many demands for further and more extended measurements, that the Legislature of 1901 appropriated $1,500 for the purpose. This has been applied to the streams whose measurements were most needed, and the total results to date are here published at pages 347 to 616.

Under the provisions of this law, which is similar in effect to existing laws in other States, the State Engineer has arranged a system of co-operation with the United States Geological Survey by which the State has the full benefit of the experienced and skillful observers of this Department and of their accurate instruments and methods, and thus obtains, at a merely nominal cost, information which is already of evident value which will be increased by continuance.

Under this law observations have been continued during 1900 and 1901 at a number of stations at which observations have heretofore been made by voluntary observers, acting under the direction of the United States Geological Survey, and there

have also been added other stations. Most of the former stations where observations had been made were located at dams where it was found that the records were rendered uncertain by the leakage of the dams, the changes in the crests of the dams by flash-boards and by leakages from the flumes and other works connected with the dams.

In selecting the new stations, they have been located with a view of avoiding these uncertainties by making observations in unobstructed reaches of the streams where the flow is, so far as possible, uniform, and where the flow of water at various stages can be determined by current meters. Gauges for the height of stream are set at these points and are observed twice a day by resident observers who record the readings and report them to the central office. There are 22 of these paid resident observers and they receive an average of $4.30 per month each. One gauge is usually set for a low stage, and this is submerged at high water, when readings are made on another gauge set for this purpose near the top of the river bank.

To determine the mean volume of water passing day by day it is only necessary to have a skilled observer, with a current meter, visit each station for a few hours at times when the stream is at various heights and thus to determine by observations made with the meter the amounts of water passing for different heights of the gauge reading, the discharge of the stream being fairly constant for a given height on the gauge and increasing in more or less regular ratio as the water level rises. It is thus practicable to construct for each stream a table showing the amount of water passing for any given height, and thus to obtain, by combining the daily gauge readings of the local observers with the occasional meter readings of the skilled observers, a complete record of the flow of the stream.

When satisfactory conditions of regular flow are found near a bridge, gauges are so located that the meter observations can

be made from the bridge spanning the stream; but such locations are avoided if the flow is much disturbed by bridge piers, making accurate records impossible and producing misleading results.

In some cases (as on the Oswego river 8 miles from Lake Ontario), a fixed wire cable is stretched across the stream well above high-water level, and the observer makes meter-readings from a car in which he travels upon this cable.

It is intended to establish these meter stations upon all the streams where it is practicable, and to gradually discontinue the observations at dams where the conditions are unsatisfactory.

In collecting for publication the records obtained during 1900, there have also been collected certain heretofore unpublished former records of these streams, and the results are here given in tables showing the daily mean flow, and also hydrographs which give the same information graphically, and which show at a glance the periods of high water and of low water, and the regular or erratic character of the flow of the various streams, which differ widely with the varied nature of their watersheds. The hydrograph of the Oswego river, for instance, is exceptionally uniform, showing the effect of natural regulation of its flow by the many central New York lakes which it drains. The hydrographs of several of the creeks which flow into the Mohawk show sudden and extreme variations, resulting from the quick run-off which is characteristic of their watersheds.

The tables give the daily means of flow in more detailed form, and such photographs are given as are necessary to show the varied conditions existing at the several stations.

The results which have been obtained are largely due to the effective attention and efforts of Mr. F. H. Newell, hydrographer of the United States Geological Survey at Washington, and of Mr. R. E. Horton, United States Geological Survey, in local

charge, whose detailed report, with the figures and tables which show the results, is appended at pp. 347 to 616.

The value of these records is such as to show that the system should be extended and made to include many other important streams in different parts of the State, and the appropriation of $1,500 is recommended for this purpose.

CONCLUSION.

In closing this, my third annual report, it is desired to express my appreciation of the courtesies shown me by the Governor and by the various officials of the State, and also to acknowledge the ability and efficiency shown by the employees of this Department.

Respectfully submitted,

EDWARD A. BOND,

State Engineer and Surveyor of New York.

APPENDIX A.

ENGINEERING EXPENSES FOR FISCAL YEAR ENDING SEPTEMBER 30, 1901.

ENGINEERING EXPENSES FOR FISCAL YEAR ENDING SEPTEMBER 30, 1901.

Ordinary Repairs of Canals.

WORK.	ACT. Chap.	ACT. Year.	Division.	Amount.	Totals.
Erie canal	570 / 418	1899 / 1900	Eastern	$8,694 56	
Champlain canal	570 / 418	1899 / 1900	Eastern	4,355 61	
					$13,050 17
Erie canal	418	1900	Middle	$6,756 28	
Oswego canal	418	1900	Middle	567 12	
Black River canal	418	1900	Middle	253 97	
Cayuga and Seneca canals	418	1900	Middle	448 88	
					8,026 25
Erie canal	570 / 418	1899 / 1900	Western	$7,100 82	
					7,100 82
Total	....	.....	....	....	$28,177 24

Extraordinary Repairs of Canals.

WORK.	ACT. Chap.	ACT. Year.	Division.	Amount.	Totals.
Erie canal	208	1899	Eastern	$124 56	
Waste-weir No. 8	311	1900	Eastern	68 22	
Champlain canal	208	1899	Eastern	70 00	
Searles waste-weir No. 9	311	1900	Eastern	1,059 72	
Aqueduct No. 3	311	1900	Eastern	787 37	
Repairing and improving vertical walls, section 2	311	1900	Eastern	130 00	
					$2,239 94
Erie Canal.					
Richmond aqueduct	311	1900	Middle	$49 57	
Black River Canal.					
Repairing Wells Brook aqueduct	311	1900	Middle	569 96	
Rebuilding Pitcher's waste-weir	311	1900	Middle	394 12	
Improving locks	311	1900	Middle	268 11	
					1,281 76
Erie Canal.					
Fish Creek culvert	208	1899	Western	$25 00	
Brockville waste-weir	208	1899	Western	25 00	
South St. Paul street wall	208	1899	Western	41 28	
Albion waste-weir	208 / 311	1899 / 1900	Western	1,303 65	
State yard, Lockport	208	1899	Western	73 32	
Bridges Nos. 144 and 183	311	1900	Western	394 28	
Vertical wall, section IX	311	1900	Western	56 05	
Repairing abutment, bridge No. 128	311	1900	Western	140 60	
Culvert No. 50, Spencerport	311	1900	Western	69 16	
Vertical walls, bridge No. 135	311	1900	Western	41 75	
Repairing culvert No. 38, Brighton	311	1900	Western	38 35	
Waste-weir, Brockport	311	1900	Western	12 78	

Extraordinary Repairs of Canals—(Concluded).

WORK	ACT.		Division.	Amount.	Totals.
	Chap.	Year.			
Erie Canal.					
Vertical wall, bridge No 133	311	1900	Western	$3 18	
Vertical walls, Lockport	311	1900	Western	22 54	
Rebuilding vertical walls, bridge No. 116	311	1900	Western	33 05	
Rebuilding slope walls, Widewaters, west of Rochester	311	1900	Western	109 01	
Vertical wall, Albion	311	1900	Western	219 73	
Bridges Nos. 132, 147, 154, 160	311	1900	Western	307 31	
Rebuilding vertical walls, Genesee Valley feeder	311	1900	Western	87 41	
Repairing and improving locks Nos. 53 to 66	311	1900	Western	141 96	
Rebuilding vertical walls, Lower Town, Lockport	311	1900	Western	186 62	
Rebuilding abutment, bridge No. 124	311	1900	Western	122 63	
Raising slope walls from 1,000 feet west of bridge No. 59 to lock No 63	311	1900	Western	107 95	
Vertical wall, bridge No. 147	311	1900	Western	7 14	
Vertical wall, bridge No. 115	311	1900	Western	3 65	
					$3,573 43
Total	...	......	....	....	$7,095 13

Special Works.

WORK.	ACT.		Division.	Amount.	Totals.
	Chap	Year.			
Bridge over Erie canal, town of Minden	457 596	1900 1899	Eastern	$540 86	
Twenty-third street bridge, Watervliet	440	1900	Eastern	1,150 00	
Vertical wall on Glens Falls feeder near power house of electric street railway, Warren county	438	1900	Eastern	845 50	
Bridge over Champlain canal, town of Waterford	629 219 443	1898 1899 1900	Eastern	1,032 60	
Saranac dam and lock	627 417 427 688	1898 1900 1900 1901	Eastern	330 05	
Improving Shinnecock canal	419	1900	Eastern	898 95	
Old field notes, maps, etc	569	1899	Eastern	578 80	
					$5,376 26
Fence around Geddes basin	347	1901	Middle	$41 83	
Inserting pipes at South lake	347	1901	Middle	399 08	
Improving harbor, Canandaigua lake	218	1900	Middle	22 14	
Bridges at Montezuma	224	1900	Middle	303 72	
Continuing new road, Indian reservation	645	1901	Middle	21 80	
Brasher Falls dam, St. Regis river	645	1901	Middle	150 80	
Erie Canal.					
Washington street bridge, Utica	397 402 537	1898 1900 1900	Middle	765 23	
Schuyler street bridge, Utica	427 417	1898 1900	Middle	557 42	
George street bridge, Rome	625 572 417 451	1898 1899 1900 1900	Middle	1,000 00	
Peterboro street bridge, Canastota	626 417	1898 1900	Middle	79 33	
Catherine street bridge, Syracuse	424 547	1898 1900	Middle	815 49	

Special Works—(Continued).

WORK.	Act. Chap.	Act. Year.	Division.	Amount	Totals.
Foreman street bridge, Cazenovia	437	1900	Middle	$911 00	
Completing bridge at inlet, Otisco lake	387 417	1900 1900	Middle	136 24	
Improving Limestone creek	419	1900	Middle	127 89	
Repairing wall at Skaneateles	419	1900	Middle	35 46	
Repairing sea walls, Owasco lake	419	1900	Middle	16 38	
Oswego Canal.					
Filling north side cut, Spring st., Syracuse	645	1901	Middle	62 15	
Raising Oswego dam, Oswego river	645	1901	Middle	60 65	
Raising high dam, Oswego river	645	1901	Middle	30 53	
Raising Minetto dam, Oswego river	645	1901	Middle	32 50	
Repairing bridge over Oneida river at Three River Point	445	1900	Middle	183 15	
Cayuga and Seneca Canal.					
Guard lock and regulating Seneca lake	680	1900	Middle	3,078 05	
Extending tow path, Geneva	662	1900	Middle	1,587 70	
Bridge at Seneca Falls	224 396	1899 1900	Middle	517 46	
Dredging inlet and repairing pier, Cayuga lake	642	1901	Middle	170 00	
Abutments, bridge at Penn Yan	455	1900	Middle	475 70	
Repairing approach Liberty street bridge, Penn Yan	681	1901	Middle	24 83	
Black River Canal.					
Bridge at Pratt's Landing, Black river	670 645	1900 1901	Middle	154 40	
					$11,790 43
Erie Canal.					
Spencerport waste-weir	201	1900	Western	$336 79	
Mud creek improvement	572	1899	Western	380 06	
Culvert, Third avenue and Ironton street, North Tonawanda	423	1900	Western	265 78	
Beemon's, Gott's and Ransom's creek improvement	442	1900	Western	138 98	
Eighteen Mile creek improvement	609 151	1899 1900	Western	676 85	
Ohio street bridge, Clark & Skinner canal	695	1901	Western	103 44	
West avenue bridge	519	1899	Western	2,423 61	
Medina bridge, Oak Orchard feeder	426 569	1900 1899	Western	127 81	
Chapel street bridge	573 416	1899 1900	Western	1,322 35	
Pine and Lock street bridge	430	1900	Western	3,933 64	
Plymouth avenue bridge	732	1901	Western	94 00	
Lyell avenue foot bridge	645	1901	Western	83 05	
Ferry street bridge	618	1899	Western	117 56	
Vertical wall, Eagle Harbor	686	1901	Western	37 96	
Corning dyke, Steuben county	441	1900	Western	342 00	
Chemung river dyke	231	1900	Western	1,191 48	
Conewango creek improvement	448	1900	Western	503 15	
Glen creek improvement	699	1901	Western	111 80	
Cattaraugus creek bridge, Versailles	685	1901	Western	115 28	
Clear creek bridge, Cattaraugus Indian reservation	569 419	1899 1900	Western	557 88	
Chemung canal, Watkins	447	1900	Western	230 21	
					13,092 68
Total	......	......	....	....	$30,259 37

Bureau of Bridge Design and Inspection.

(Chapter 476, Laws of 1899; chapter 569, Laws of 1899; chapter 419, Laws of 1900, and chapter 645, Laws of 1901.)

NAME.	Rank.	Rate of compensation.	Salary.	Travel.	Total.
Wm. R. Davis	Chief Bridge Designer	$2,800 00 per year	$2,800 00	$356 11	$3,156 11
C. T. Middlebrook	1st Ass't Engineer	6 00 per day	1,308 00	210 67	1,518 67
J. G. Peck	Bridge Designer	166 67 per month	1,258 36	108 52	1,366 88
G. A. Fairbanks	Ass't Engineer	5 00 per day	1,312 50	....	1,312 50
L. B. Jones	Leveler	4 50 per day	1,206 00	3 11	1,209 11
					$8,563 27
Incidental Expenses.					
Drafting Instruments, drawing and blue-print paper, tracing cloth, etc					144 86
Total					$8,708 13

Special Surveys.

NAME.	ACT. Chap.	ACT. Year.	Division.	Amount.	Total.
Herkimer and Hamilton Co., boundary line	419	1900	Eastern	$1,872 27	
Surveys Forest and Preserve Board	419 645	1900 1901	Eastern	2,409 67	
Surveys for State Board of Claims	419	1900	Eastern	6,293 23	
Blue Line Maps, Erie, Oswego, and Champlain canals	569	1899	Eastern	1,282 50	
Examination Monuments, Maps, etc	569 419	1899 1900	Eastern	3,327 43	
Topographic Survey	386 645	1900 1901	Eastern	22,141 04	
Hydrography	420 645	1900 1901	Eastern	2,095 62	
Apron dam, Pinekill	621 388	1898 1900	Eastern	106 60	
Survey for barge canal	411	1900	Eastern	566 59	
Survey for barge canal, Head Office Payments	411	1900	Eastern	68,605 11	
					$108,700 06
Surveys for State Board of Claims	419	1900	Middle	$2,518 61	
Survey for barge canal	411	1900	Middle	4.374 92	
					$6,893 53
Surveys for State Board of Claims	419	1900	Western	$3,655 12	
Survey for barge canal	411	1900	Western	1,081 28	
					4,736 40
Total	......	......	....	....	$120,329 99

Highway Improvements.

NAME.	ACT. Chap.	ACT. Year.	Division.	Amount.	Total.
Surveys and plans and construction	115	1898	Eastern.....	$38,764 04	$38,854 04
Surveys and plans and construction	115 569 419 293	1898 1899 1900 1900	Middle	5,456 40	5,456 40
Surveys and plans and construction	115 569 419 293 642	1898 1899 1900 1900 1901	Western....	20,498 45	20,498 45
Total...........................	......	....	....	....	$64,718 89

Summary of Engineering Expenses for the Fiscal Year Ending September 30, 1901.

DIVISION.	Ordinary repairs of canals.	Extraordinary repairs of canals.	Bureau of Bridge Design.	Special works.	Special surveys.	Highway improvements.	Total.
Eastern...........	$13,050 17	$2,239 94	....	$5,376 26	$108,700 06	$38,764 04	$168,130 47
Middle...........	8,026 25	1,281 76	....	11,790 43	6,893 53	5,456 40	33,448 37
Western..........	7,100 82	3,573 43	....	13,092 68	4,736 40	20,498 45	49,001 78
Bureau of Bridge Design.........	....	....	$8,708 13	....	....	....	8,708 13
Total	$28,177 21	$7,095 13	$8,708 13	$30,259 37	$120,329 99	$64,718 89	$259,288 75

The following tables show the present condition of the 74 contracts for canal improvement made under chapter 79, Laws of 1895, and chapter 794, Laws of 1896, being the so-called "Nine Million Dollar Improvement" Act:

Table I.

The following named contractors have applied for the termination of contracts under chapter 544, *Laws of* 1899:

Clinton Beckwith	Contract No.	28	Eastern	Division.
Clinton Beckwith	"	27	"	"
John V. Quackenbush	"	16	"	"
John V. Quackenbush	"	24	"	"
O'Brien & Hoolihan	"	19	Middle	"
Edward H. Gaynor	"	23	"	"
Willoughby B. Priddy	"	27	"	"
John Dunfee & Co.	"	4	"	"
John Dunfee & Co.	"	26	"	"
Kirk, Driscoll & Co	"	34	"	"
John Kelly & Co.	"	7	"	"
John Kelly & Co.	"	8	"	"
John Kelly & Co.	"	9	"	"
Hughes Bros. & Bangs	"	10	"	"
Lauer & Hagaman	"	6	Eastern	"
Lauer & Hagaman	"	18	"	"
Whitmore, Rauber & Vicinus	"	14	Western	"
Whitmore, Rauber & Vicinus	"	15	"	"
Dodge & McGregor	"	6	Middle	"
Troy Public Works Co.	"	19	Eastern	"
Buffalo Dredging Co.	"	2	Western	"
Baker, Banker & Hingston	"	29	Eastern	"
Baker & Banker	"	7	Western	"
Warren Scharf Asphalt Paving Co	"	20	Middle	"
Warren Scharf Asphalt Paving Co.	"	21	"	"
Henry C. Allen & Co.	"	13	Western	"
Walter Bradley	"	46	Middle	"
Mahan & Sundstrom	"	10	Eastern	"
Grannis & O'Connor	"	5	Western	"

Table II.

The following named contractors have applied for the termination of contracts under chapter 81, *Laws of* 1900:

Warren Scharf Asphalt Paving Co.	Contract No.	20	Middle	Division.
Warren Scharf Asphalt Paving Co.	"	21	"	"
Henry C. Allen & Co.	"	13	Western	"
John W. Whalen	"	2	Eastern	"
Gallo & McNiece	"	4	"	"
Brummelkamp, Lane & Co.	"	5	"	"
T. J. Dwyer & Co.	"	1	Middle	"
McDonald & Sayre	"	2	"	"
John Dunfee & Co.	"	3	"	"
John Dunfee & Co.	"	5	"	"
O'Brien & Hoolihan	"	18	"	"
National Contracting Co.	"	22	"	"
National Contracting Co.	"	24	"	"
National Contracting Co.	"	25	"	"
Pulford & Compton	"	28	Eastern	"
Grannis & O'Connor	"	5	Western	"

Table III.

The following named contractors have made no application for termination of contracts under either chapter 544, *Laws of* 1899, *or chapter* 81, *Laws of* 1900:

Andrew Onderdonk	Contract No.	28	Middle	Division.
Furnaceville Iron Company	"	6	Western	"
Williams, McNaughton & Bapst	"	8	"	"
Furnaceville Iron Company	"	9	"	"
Furnaceville Iron Company	"	10	"	"
Furnaceville Iron Company	"	11	"	"
Furnaceville Iron Company	"	12	"	"

Table IV.

CONTRACTS COMPLETED AND PAID.

John V. Quackenbush	Contract No.	7	Eastern	Division.
Chambers & Casey	"	11	"	"
Shear & Haight	"	12	"	"
John V. Quackenbush	"	13	"	"
Thomas H. Karr	"	15	"	"
Thomas H. Karr	"	17	"	"
John Twomey	"	52	"	"
T. J. Dwyer & Co	"	12	Middle	"
Hughes Bros & Bangs	"	13	"	"
John Kelly & Co	"	14	"	"
Owego Bridge Co	"	17	"	"
Rochester Bridge and Iron Works	"	47	"	"
Donnelly Contracting Co	"	1	Western	"
Whitmore, Ranber & Vicinus	"	4	"	"
Randerson & Seward	"	11	Middle	"
Walter Bradley	"	15	"	"
Edwin Lodder	"	36	"	"
Edwin Lodder	"	16	"	"
Willard Johnson	"	37	"	"
Whalen & Higgins	"	8	Eastern	"
John W. Whalen	"	9	"	"
John W. Flynn	"	30	"	"
C J. Reardon & Co	"	31	"	"
Monty & Higley	"	53	"	"
Lauer & Hagaman	"	3	"	"
Clinton Beckwith	"	23	"	"
Clinton Beckwith	"	27	"	"
John V. Quackenbush	"	16	"	"
John V. Quackenbush	"	24	"	"
O'Brien & Hoolihan	"	19	Middle	"
Edward H. Gaynor	"	23	"	"
Willoughby B. Priddy	"	27	"	"
John Dunfee & Co	"	4	"	"
John Dunfee & Co	"	26	"	"
Kirk, Driscoll & Co	"	34	"	"
John Kelly & Co	"	7	"	"
John Kelly & Co	"	8	"	"
John Kelly & Co	"	9	"	"
Hughes Bros. & Bangs	"	10	"	"
Lauer & Hagaman	"	6	Eastern	"
Lauer & Hagaman	"	18	"	"
Whitmore, Ranber & Vicinus	"	14	Western	"
Whitmore, Ranber & Vicinus	"	15	"	"
Dodge & McGregor	"	6	Middle	"
Troy Public Works Co	"	19	Eastern	"
Baker, Banker & Hingston	"	29	"	"
T J. Dwyer & Co	"	1	Middle	"
John Dunphy & Co	"	3	"	"
John Dunphy & Co	"	5	"	"
Gallo & McNiece	"	4	Eastern	"
O'Brien & Hoolihan	"	18	Middle	"
Brummelkamp Lane & Co	"	5	Eastern	"
McDonald & Sayre	"	2	Middle	"
National Contracting Co	"	22	"	"
National Contracting Co	"	24	"	"
National Contracting Co	"	25	"	"
John W. Whalen	"	2	Eastern	"
Giannis & O'Connor	"	5	Western	"
Mahan & Sundstrom	"	10	Eastern	"
Walter Bradley	"	46	Middle	"

Total—60 contracts.

CANCELLED CONTRACT FINISHED BY DEPARTMENT OF PUBLIC WORKS.

Chas. F. Parker & Co ... Contract No. 3 Western Division

Total—1 contract.

Table V.

Contracts whose settlements were considered by the Canal Board under chapter 81, *Laws of* 1900, *but which have not been terminated.*

Warren Scharf Asphalt Paving Co	Contract No. 20	Middle	Division.
Warren Scharf Asphalt Paving Co	" 21	"	"
Pulford & Compton	" 28	Eastern	"
Henry C. Allen & Co	" 13	Western	"

Total—4 contracts.

Table VI.

CONTRACTS PENDING BEFORE THE COURT OF CLAIMS.

Andrew Onderdonk	Contract No. 28	Middle	Division.
Williams, McNaughton & Bapst	" 8	Western	"
Furnaceville Iron Co	" 6	"	"
Furnaceville Iron Co	" 9	"	"
Furnaceville Iron Co	" 10	"	"
Furnaceville Iron Co	" 11	"	"
Furnaceville Iron Co	" 12	"	"
Buffalo Dredging Co	" 2	"	"
Baker & Banker	" 7	"	"

Total—9 contracts.

The above lists, Tables IV to VI, include all the contracts, 74 in number, under the so-called "9 million" improvement work.

APPENDIX.

Improvement of Public Highways.

STATE OF NEW YORK.

CHAP. 115, LAWS OF 1898.

AN ACT to provide for the improvement of the public highways. Became a law March 24, 1898, with the approval of the Governor.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

Section 1. The board of supervisors in any county of the state may, and upon presentation of a petition as provided in section two hereof, must pass a resolution that public interest demands the improvement of any public highway, or section thereof situate within such county, and described in such resolution, but such description shall not include any portion of a highway within the boundaries of any city or incorporated village, and within ten days after the passage of such a resolution shall transmit a certified copy thereof to the state engineer and surveyor.

§ 2. The owners of a majority of the lineal feet fronting on any such public highway or section thereof in any county of the state may present to the board of supervisors of such county a petition setting forth that the petitioners are such owners and that they desire that such highway or section thereof be improved under the provisions of this act.

§ 3. Such state engineer upon receipt of such resolution shall investigate and determine whether the highway or section thereof sought to be improved is of sufficient public importance to come within the purposes of this act, taking into account the use, location and value of such highway or section thereof for the purposes of common traffic and travel, and after such investigation shall certify his approval or disapproval of such resolution. If he shall disapprove such resolution, he shall certify his reasons thereof to such board of supervisors.

§ 4. If he shall approve such resolution, such state engineer shall cause the highway or section thereof therein described to be mapped both in outline and profile. He shall indicate how much of such highway or section thereof may be improved by deviation from the existing lines whenever it shall be deemed of advantage to obtain a shorter or more direct road without lessening its use-

fulness or wherever such deviation is of advantage by reason of lessened gradients. He shall also cause plans and specifications of such highways or section thereof to be thus improved to be made for telford, macadam or gravel roadway or other suitable construction, taking into consideration climate, soil and materials to be had in the vicinity thereof and the extent and nature of the traffic likely to be upon such highway, specifying in his judgment the kind of road a wise economy demands. The improved or permanent roadway of all highways so improved shall not be less than eight feet nor more than sixteen feet in width unless for special reasons to be stated by such state engineer it is required that it shall be of greater width. He shall if requested by the resolution include provision for steel plate or other flat rail construction in double track.

§ 5. Upon the completion of such maps, plans and specifications such state engineer shall cause an estimate to be made of the cost of construction of the same and transmit the same to the board of supervisors from which such resolution proceeded, together with a certified copy of such maps, plans and specifications, and of his certificate of the approval of the highway or section thereof so designated as aforesaid.

§ 6. After the receipt thereof upon a majority vote of such board of supervisors, it may adopt a resolution that such highway or section thereof so approved shall be constructed under the provisions of this act, or of any existing act, and thereupon shall transmit a certified copy of such resolution to such state engineer.

§ 7. In case the boundaries of such proposed highway shall deviate from the existing highway, the board of supervisors must make provision for securing the requisite right of way prior to the actual commencement of the work of improvement.

§ 8. Upon receipt of the certified copy of the resolution provided in section six, such state engineer shall advertise for bids for two successive weeks in a newspaper published at the county seat of such county, and in such other newspaper as shall be deemed of advantage for the construction of such highway or section thereof, according to such plans and specifications, and award such contract to the lowest responsible bidder, except that he may in his discretion award the contract to the board of supervisors of the county or the town board or boards of the town or towns in which such highway lies, and except that no contract shall be awarded at a greater sum than the estimate provided in section five. But if no bid otherwise acceptable be made within such estimate, such state engineer may amend his estimate, certify the same to the board of supervisors, and upon the adoption by it of a resolution as provided in section six based on such amended estimate, proceed anew to obtain bids and award the contract as herein provided. Such engineer may reject any or all bids, and before entering into any contract for such construction he shall require a bond with sufficient sureties conditioned that if the proposal shall be accepted, the party thereto will perform the

work upon the terms proposed and within the time prescribed and in accordance with the plans and specifications; and as a bond of indemnity against any direct or indirect damages that shall be suffered or claimed during the construction of such road; and until the same is accepted. The people of the state of New York shall in no case be liable for any damages suffered. Partial payments may be provided for in the contract, and paid in the manner herein provided when certified to by such state engineer to an amount not to exceed seventy-five per centum of the value of the work done; twenty-five per centum of the contract price shall be retained until the entire work has been accepted. Whenever a county engineer has been appointed in the county in which such highway or section thereof is to be constructed, he shall have general charge and supervision of the work under the direction of such state engineer and shall report to him from time to time the progress of the work and such facts in relation thereto as may be required. If there is no county engineer, such state engineer shall have some competent person to superintend and have engineering supervision of the work.

§ 9. One-half of the expense of the construction thereof shall be paid by the state treasurer upon the warrant of the comptroller, issued upon the requisition of such engineer, out of any specific appropriations made to carry out the provisions of this act. And one-half of the expense thereof shall be a county charge in the first instance, and the same shall be paid by the county treasurer of the county in which such highway or section thereof is, upon the requisition of such engineer, but the amount so paid shall be apportioned by the board of supervisors, so that if the same has been built upon a resolution of said board without petition, thirty-five per centum of the cost of construction shall be a general county charge; and fifteen per centum shall be a charge upon the town in which the improved highway or section thereof is located, and if the same has been built upon a resolution of said board after petition as provided in section two, thirty-five per centum shall be a general county charge and fifteen per centum shall be assessed upon and paid by the owners of the lands benefited in the proportion of the benefits accruing to said owners as determined by the town assessors in the next section hereof.

§ 10. The town assessors of any town in which any highway or section thereof has been improved or constructed pursuant to petition as provided in section two of this act, shall have power and it shall be their duty upon receiving notice from the board of supervisors of the county in which said town is located, of the cost of construction or improvement of such highway or section thereof in such town, to assess an amount equal to fifteen per centum of said total cost upon the lands fronting or abutting on such highway or section thereof. Such assessment shall be apportioned according to the benefits accruing to the owners of the lands so located, according to the best judgment of said assessors, upon at least ten days' notice of the time and place of such

apportionment to the persons affected thereby, and after such persons have had an opportunity to be heard, and the assessments so made when duly attested by the oaths of such assessors shall be collected in the same manner as the general taxes of such town are collected.

§ 11. The construction and improvement of highways and sections thereof, under the provisions of this act, shall be taken up and carried forward in the order in which they are finally designated, as determined by the date of the receipt in each case of the certified copy of the resolution provided in section six by such engineer as hereinbefore provided.

§ 12. Upon the completion of such highways or section thereof, so constructed by such engineer, and his acceptance of the same, and after payment has been made, as herein provided, such engineer shall inform the board of supervisors of such county that the highways or sections thereof designated have been constructed as herein provided, and his duties in regard to the same are finished; and he may serve notice on said board to accept such highway thus constructed, which notice shall be filed in the office of the clerk of said county; and twenty days after the service and filing of said notice, such highway or section thereof shall be deemed accepted by said board of supervisors of such county; and thereafter they shall maintain the same as a county road, and apportion the expense as they may be empowered by law.

§ 13. All persons owning property abutting on such road so improved, or residing thereon, shall thereafter pay all highway taxes assessed against them in money, in the manner now provided by law.

§ 14. Whenever any county has had aid in building any such highway, and it seems advantageous to such state engineer that a section or sections of highway, not exceeding one mile in length, should be constructed under this act to connect these roads together, and would be of great public utility and general convenience, he may serve notice on the board of supervisors of such county, and shall file one in the county clerk's office, designating the highways already constructed and the existing termini, and the section or sections, in his opinion, necessary to be constructed and his reasons therefor. And it shall be the duty of the board of supervisors to provide for the construction of such connecting highway or section thereof, within one year after the service and filing of such notice under this act.

§ 15. In addition to his other powers and duties, the state engineer and surveyor shall compile statistics relative to the public highways throughout the state and shall collect all information in regard thereto deemed expedient. He shall investigate and determine upon various methods of road construction adapted to different sections of the state, and as to the best methods of con-

struction and maintenance of roads and bridges, and such other information relating thereto as he shall deem appropriate. He may be consulted at all reasonable times by county, city, town or village officers having care and authority over highways and bridges, and shall advise such officers relative to the construction, repair, alteration or maintenance of the same; and shall furnish such other information and advice as may be requested by persons interested in the construction and maintenance of public highways, and shall, at all times, lend his aid in promoting highway improvement throughout the state. He shall hold in each year at least one public meeting in each county, and shall cause due notice of such meeting to be given. He shall co-operate with all highway officers and shall assist county and town authorities, and when requested by them, furnish them with plans and directions for the improvement of the public highways and bridges.

§ 16. He shall report annually to the legislature concerning all the work performed by him, together with such recommendations upon the subject of highway construction and maintenance as to him shall seem appropriate.

§ 17. The commissioners of highways and town board of any town, and the board of supervisors of any county, and all other officers who now have or may hereafter have by law the care and supervison of the public highways and bridges shall, from time to time, upon his written request, furnish him with all available information in connection with the building and maintenance of the public highways and bridges in their respective localities.

§ 18. The operation of this act shall not be affected by any special act, but the highways may be improved under this act or such special act wherever the same may now exist.

§ 19. This act shall take effect immediately.

In order to provide for the maintenance of the roads built under chapter 115 of the Laws of 1898, it was amended as follows:

CHAP. 293.

AN ACT to amend chapter one hundred and fifteen of the laws of eighteen hundred and ninety-eight, entitled "An act to provide for the improvement of public highways," in relation to the powers of the state engineer and surveyor.

Became a law, April 6, 1901, with the approval of the Governor. Passed, three-fifths being present.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

Section 1. Section twelve of chapter one hundred and fifteen of the laws of eighteen hundred and ninety-eight, is hereby amended to read as follows:

§ 12. Upon the completion of such highways or sections thereof, so constructed by such engineer, and his acceptance of the same, and after payment has been made, as herein provided, such engineer shall inform the board of supervisors of such county that the highways or sections thereof designated have been constructed as herein provided, and he may serve notice on said board to accept such highway thus constructed, which notice shall be filed in the office of the clerk of said county and twenty days after the service and filing of said notice, such highway or section thereof shall be deemed accepted by said board of supervisors of such county; and thereafter they shall maintain the same as a county road, and apportion the expense as they may be empowered by law, and the commissioners of highways of the town or towns respectively wherein such improved highways lie shall care for and keep the same in repair, under the direction and supervision of the state engineer and surveyor and such rules and regulations as he may prescribe.

§ 2. This act shall take effect immediately.

WIDE TIRES.

Many tests have been made to establish the claims in favor of wide tires as against the narrow ones, and a few of the results are given as stated in Bulletin 12 of the United States Department of Agriculture by General Roy Stone. In Utah, at the experiment station, it was shown that a given load on 1½ inch tire pulled 40 per cent. heavier than when on a 3-inch tire, the test being made on grass sod. On a moist, but hard road, the percentage was 12.7 in favor of the 3-inch tire. In Ohio a wide tire test was made at the State University. An ordinary wagon with a new 3-inch tire was loaded with two long tons, or 4,480 pounds, and the draft measured by a dynamometer. On an ordinary earth road, in good condition and hard, the draft was 254 pounds. On a grass field it was 468 pounds. On a newly plowed field it was 771 pounds. As 150 pounds is the draft of an ordinary horse of 1,000 pounds, two horses could draw this load with ease on an ordinary road, and a ton and one-half on a grass sod, while with a narrow tire one-half as much, or a single ton, is a full load for a double team. Besides this the broad

tires roll and level a road so that the more they are used the better the road becomes, while narrow tires cut it into ruts if it is at all soft.

Professor Sanborn of the Missouri Agricultural College tried the same experiment with wagons having tires of different widths, using a Baldwin dynamometer. The weight of the load drawn was 3,665 pounds each. The tires were 1½ inches and 3 inches respectively. The tests were made on blue grass sod partially moist. The draft of the wide tires averaged for level ground 310 pounds. For the narrow tires the draft was 439 pounds, or 41.6 per cent. more than the wide tire. Assuming the wagon to weigh 1,000 pounds, then on the broad tire 3,248 pounds would be drawn as easily as 2,000 pounds on the narrow tires. Again, the broad wheels in the trial did not injure the turf, while the narrow wheels cut through it.

The following report is made by the Vermont Highway Commission:

"If the present law was so amended as to limit the allowed weight per inch of tire to a definite number of pounds, we believe this would best accomplish the desired result. To determine what this limit should be, we have measured and weighed a large number of wagons representing a great variety of the heavier traffic in the State, and have concluded that the maximum weight, including wagon, allowed per inch of tire should be 550 pounds. This is higher than that placed by most authorities, but far less than the average on city pavements. The following table shows the load, including the weight of the wagon, that could be carried under such a regulation on varying sizes of tires."

Width of tire in inches.	Allowed load, including weight of wagon, pounds.	Width of tire in inches.	Allowed load, including weight of wagon, pounds.
2	4,400	3½	7,700
2¼	4,950	3¾	8,250
2½	5,500	4	8,800
2¾	6,050	4½	9,900
3	6,600	5	11,000
3¼	7,150	6	13,200

For vehicles with suitable springs the allowed load could probably be increased one-third.

It will be seen, therefore, that the wide tires are not only lighter in their draft than narrow ones under nearly all conditions, but they cut up the road very little; in fact, when 6 inches wide they tend to make the road continually better.

That this subject has had the closest attention paid to it in Europe, is proven by the regulations adopted in the various countries, as reported by the United States consuls.

In Austria all wagons built for a load of more than 2¼ tons must have wheels with rims at least 4 1-3 inches wide (Styria and Carinthia), and if built for more than 4½ tons (in Styria) or more than 3½ tons (in Carinthia) the rims must be at least 6¼ inches broad. In lower Austria a width of rim of 4½ inches is required for loaded wagons drawn by two or three horses. In Bohemia the same regulation applies.

In France every freight and market wagon is a roadmaker. The tires are from 3 to 10 inches in width, usually from 4 to 6. With the few four-wheeled vehicles used the tires are rarely less than 6 inches in width, and the rear axle is about 14 inches longer than the fore axle, so that the rear or hind wheels run about one inch outside of the level rolled by the front wheels.

In Germany the rule prescribes that all the wagons drawing heavy loads such as coal, brick, earth, stone, etc., must have tires at least 4 inches wide.

By carefully noting these regulations, one will see that in the European countries they have long ago discarded the narrow tires, much to the advantage of their roads and the saving of

their horses and vehicles; and it is to be hoped that the American farmer, after digesting these statements, will see the advantage of such a self-evident proposition and follow their example.

The following quoted act gives to the supervisors of any county the power to enact local laws regarding the width of tires. Monroe county has enacted such a law, taking effect March 1, 1900.

CHAP. 155.

AN ACT to amend the county law relating to powers of boards of supervisors with reference to tires on vehicles.

Became a law March 28, 1899, with the approval of the Governor. Passed, three-fifths being present.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

Section 1. Section seventy-nine of chapter six hundred and eighty-six of the laws of eighteen hundred and ninety-two, entitled "An act in relation to counties, constituting chapter eighteen of the general laws," as amended by chapter six hundred and forty-four of the laws of eighteen hundred and ninety-four, is hereby amended so as to read as follows:

§ 79. Powers as to tires on vehicles.—The board of supervisors may enact local and private laws regulating the width of tires used on vehicles built to carry a weight of fifteen hundred pounds or upwards, and may provide penalties for the violation thereof.

§ 2. This act shall take effect immediately.

The following are local laws which have been enacted since the passage of the above law:

WIDE TIRES ON VEHICLES.

LOCAL LAWS.

ONEIDA COUNTY.

Section 1. Width of tires on vehicles.—There shall not be used upon any highway in this county any vehicle built to carry a weight of twenty hundred pounds and upwards to twenty-five hundred pounds unless the wheels of said vehicle shall have thereon a tire of at least three inches in width, and the wheels of all vehicles built to carry a weight of upwards of twenty-five hundred pounds shall have thereon a tire of at least four inches in width.

§ 2. Penalty.—Whoever shall violate the provisions of this act shall be liable to a penalty of five dollars for each violation.

§ 3. When to take effect.—This act shall take effect January [illegible] hundred and one.

Passed by the board of supervisors of the county of Monroe in annual session, 1899.

Number One.

AN ACT of the board of supervisors of Monroe county to regulate the width of tires used on vehicles on the highways in the county of Monroe, pursuant to chapter one hundred and fifty-five of the laws of eighteen hundred and ninety-nine, entitled "An act to amend the county laws relating to powers of boards of supervisors with reference to tires on vehicles."

Passed at the annual session of said board of supervisors, December 28, 1899, by a vote of twenty-nine for and nine against its passage.

The board of supervisors of Monroe county, pursuant to chapter 115 of the Laws of 1899, entitled "An act to amend the County Law relating to powers of boards of supervisors with reference to tires on vehicles," do enact as follows:

Section 1. No vehicle built to carry a weight of one thousand five hundred pounds or upwards shall hereafter be used, driven or propelled on or over any road heretofore or which hereafter may be improved under the provisions of the Higbie-Armstrong act, so-called, unless the same be equipped with tires of the width specified in section three hereof.

§ 2. On or after September first, nineteen hundred and one, no vehicle built to carry a weight of one thousand five hundred pounds or upwards shall be used, driven or propelled on or over any highway in the county of Monroe, unless the same be equipped with tires of the width specified in section three hereof.

§ 3. The tires used on such vehicles are hereby required to be the following widths: All wagons equipped with thimble skein axle of three inches or less in diameter, steel axles of one and five-eighths inches or less in diameter, tubular axles of two and three-eighths inches in diameter, and built to carry a weight of one thousand five hundred pounds or upwards, shall have tires not less than three inches in width. All wagons equipped with thimble skein axles of three and one-quarter inches in diameter, steel axles of one and three-quarters inches in diameter, or tubular axles two and five-eighths inches in diameter, and built to carry a weight of one thousand five hundred pounds or upwards, shall have tires of not less than three and one-half inches in width.

All wagons equipped with thimble skein axles of three and one-half inches or more, in diameter, steel axles of one and seven-eighths inches or more in diameter, tubular axles of two and seven-eighths inches or more in diameter, and built to carry a weight of one thousand five hundred pounds or upwards shall have tires of not less than four inches in width.

§ 4. This act shall not apply to platform or three-spring wagons equipped with steel axles not to exceed one and one-quarter inches in diameter.

§ 5. Any person owning any vehicle which is hauled, propelled or used contrary to the provisions of this act, as well as any person engaged in hauling, propelling, using or having charge of any such vehicle, shall be deemed guilty of the offense herein prohibited. Provided, however, that any employee may prove in extenuation of the offence charged that the same was committed pursuant to instructions of his employer and in ignorance of the fact that such vehicle did not comply with the requirements of this act, but no such defence shall be admitted on the part of the employer or owner of the vehicle, under whose direction or with whose consent the same was used.

§ 6. Any person offending against the provisions of this act shall be deemed guilty of a misdemeanor, and shall be punishable by a fine of not less than five dollars nor more than twenty-five dollars, for each offense, and in case of failure to pay any fine imposed may be committed to jail not exceeding one day for each dollar of such fine.

§ 7. Courts of special sessions, having jurisdiction to try misdemeanors as provided by section fifty-six of the code of criminal procedure, shall have exclusive jurisdiction to try offenders in all cases occurring under this act in the same manner as in other cases where they now have jurisdiction and subject to the same power of removal and to render and enforce judgment to the extent herein provided.

§ 8. All fines collected under the provisions of this act shall be paid when the offense is committed in a town to the supervisor of that town for the highway fund to be paid out by him under the direction of the town board. When the offense is committed in the city of Rochester the fine shall be paid to the city treasurer to be used as the common council may direct.

§ 9. This act shall take effect March first, nineteen hundred.

The undersigned, Edward F. Wellington, chairman of the board of supervisors of the county of Monroe, and Charles U. Bastable, clerk of said board, do hereby certify that the foregoing local law was regularly passed and adopted by the board of supervisors of Monroe county in annual session assembled, on the 28th day of December, 1899, by the vote recited in the preamble thereto.

In witness whereof said chairman and clerk have hereunto set their hands and affixed the seal of said county, this 6th day of January, in the year of our Lord one thousand nine hundred.

EDWARD F. WELLINGTON,
Chairman.

CHARLES U. BASTABLE,
Clerk.

ULSTER COUNTY.

AN ACT to protect streets and highways in the town of Shandaken, county of Ulster, New York, to regulate the width of tires on vehicles used thereon and to provide penalties for the violation thereof, pursuant to section ninety-seven of the county law.

The Board of Supervisors of Ulster County do enact as follows:

Section 1. It shall be unlawful for any person or persons, corporations or company to impair, injure or destroy any macadamized street or highway, or any street or highway constructed, built or top-dressed with broken stone in the town of Shandaken, Ulster county, New York.

§ 2. From and after the first day of April, nineteen hundred and one, the width of tires on all wagons or vehicles used upon the public highways of the town of Shandaken, Ulster county, shall be as follows:

1. Upon all vehicles built and designed to carry and carrying weight of fifteen hundred pounds and not exceeding two tons, exclusive of the weight of vehicle, the width of the tire shall be at least three inches.

2. Upon all vehicles built and designed to carry and carrying two tons or more exclusive of the weight of the vehicle, the width of the tire shall be at least four inches.

§ 3. Any person, persons, corporation or company offending against the provisions thereof, shall be deemed guilty of a misdemeanor, and upon conviction shall be punished by a fine of not exceeding twenty-five dollars or by imprisonment not exceeding twenty-five days, or by both such fine and imprisonment.

§ 4. This act shall take effect March thirty-first, nineteen hundred and one.

CITY ORDINANCE OF KINGSTON.

ULSTER COUNTY, N. Y.

AN ORDINANCE to protect the streets, avenues and highways of the city of Kingston, and regulate the width of tire on vehicles used thereon.

Passed December 7, 1900.

The Common Council of the City of Kingston do ordain as follows:

Section 1. It shall be unlawful for any person or persons, corporation or company, to impair, injure or destroy any macadamized, paved, asphalted or topdressed street, avenue or highway in said city.

§ 2. The width of tire on all wagons or other vehicles used upon any public highway within the city of Kingston shall be as follows:

1. Upon all vehicles designed to carry and carrying one ton or more, and less than two tons, exclusive of the weight of the vehicle, the width of the tire shall be at least three inches.

2. Upon all vehicles designed to carry and carrying two tons or more, exclusive of the weight of the vehicle, the width of the tire shall be at least four inches.

3. Upon all vehicles designed to carry and carrying five tons or more, exclusive of the weight of the vehicle, traveling on Washington avenue from North Front street to Linderman avenue, on Green street from North Front street to James street, on Crown street from North Front street to Green street, on Fair street from North Front street to Henry street, on Clinton avenue from North Front street to Henry street, on Henry street from Clinton avenue to Broadway, or on any other public highway in said city now or hereafter paved with blocks or sheet asphalt, the width of the tire shall be at least six inches.

§ 3. It shall be unlawful for any person or persons, corporation or company, to take up or remove any asphalt or shale brick pavement in any of the public highways of said city without first obtaining a permit therefor from the superintendent of streets of said city, and then only under the supervision of the city engineer of said city, to whose satisfaction such pavement must be replaced and repaired by the person or persons, corporation or company taking up or removing the same.

§ 4. Any person, persons, corporation or company offending against the provisions hereof shall be deemed guilty of a misdemeanor, and upon conviction shall be punished by a fine not exceeding two hundred dollars, or by imprisonment not exceeding thirty days, or by both such fine and imprisonment.

§ 5. All ordinances and parts of ordinances inconsistent with the provisions of this ordinance are hereby repealed.

§ 6. This ordinance shall take effect immediately.

STATE OF NEW YORK,
COUNTY OF ULSTER, } *ss.:*
City of Kingston,

I, John T. Cummings, city clerk of the city of Kingston, do hereby certify that I have compared the foregoing ordinance with the original on file and on record in the city clerk's office, and that the same is a correct transcript therefrom and of the whole of said original.

JOHN T. CUMMINGS,
City Clerk.

VILLAGE ORDINANCE OF SAUGERTIES.

ULSTER COUNTY, N. Y.

AN ORDINANCE to protect the streets, avenues and highways of the village of Saugerties, and to regulate the width of tire on wagons, carts and trucks used thereon.

The Board of Directors of the Village of Saugerties do ordain as follows:

Section 1. From and after the first day of September, 1897, the width of tire on all wagons, carts or trucks used upon any public street, avenue or highway within the corporate limits of the village of Saugerties shall be as follows:

1. Upon all wagons, carts or trucks, carrying a load of two thousand five hundred pounds and not more than six thousand pounds, exclusive of the weight of the wagon, cart or truck, box, rack, plank, or other construction upholding the load, the width of the tire shall not be less than three (3) inches.

2. Upon all wagons, carts or trucks, carrying a load of six thousand pounds or more, exclusive of the weight of the wagon, cart, or truck, box, rack, plank, or other construction upholding the load, the width of the tire shall not be less than four (4) inches.

§ 2. If any person traveling upon any street, avenue or highway, within the corporate limits of the village of Saugerties, with a wagon, cart or truck, upon which it is claimed by any Director, Street Commissioner, or other person appointed by the Board of Directors, that the load upon said wagon, cart or truck exceeds the weight authorized to be carried by section one of this ordinance, the person claiming the load to be in excess of the weight authorized to be carried on said wagon, cart or truck, shall at the time of making the aforesaid claim, inform the person in charge of the wagon, cart or truck, of the location of the scales upon which the wagon, cart or truck, with its load, shall be weighed, and after unloading shall again be weighed, and the difference between the two weights shall be presumptive evidence of the weight of the load. Such scale shall be designated by resolution of the Board of Directors, at which the aforesaid weighing shall be done, with the right, from time to time, to designate other scales. And if the person, persons, corporation, company, or the person in charge of said wagon, cart or truck, shall fail, or neglect to have the weighing done as hereinbefore provided, to ascertain the weight of the load, shall be presumptive evidence that the weight of the load is in excess of the weight authorized to be carried by the provisions of this ordinance.

§ 3. Any person, persons, corporation or company offending against the provisions hereof, shall forfeit and pay a penalty of fifty dollars ($50.00) for each and every offense against the provisions of this ordinance, or against any one of the provisions hereof, to be recovered in an action with costs, by the "Directors of the village of Saugerties," for the use of said village.

§ 4. This ordinance shall take effect September first, eighteen hundred and ninety-seven.

I hereby certifiy that the above is a true and correct copy, and the whole thereof, of an ordinance passed by the Directors of the village of Saugerties at a regular meeting held June fifth, eighteen hundred and ninety-seven.

(Signed.) C. H. VEDDER,
Village Clerk.

SUPERVISORS' HIGHWAY CONVENTION, HELD IN THE CITY OF ALBANY, NEW YORK, FEBRUARY 14 AND 15, 1901.

Pursuant to the request of Edward A. Bond, State Engineer and Surveyor, the following named Delegates assembled at the City Hall in Albany at 10.30 o'clock, a. m., Thursday, February 14, 1901:

County.	Delegates.	P. O. address.
Albany	Cyrus Serafford	
	Wallace A. Peasley	Rensselaerville, N. Y.
	Edward J. Bedell	Selkirk, N. Y.
	Charles Haverly	Westerlo, N. Y.
	August John	
	Charles Barhydt	
Allegany	J. S. Phillips	Andover, N. Y.
	Lloyd Miller	Canaseraga, N. Y.
Broome	David B. King	Castle Creek, N. Y.
	James M. Holt, Jr.	Port Dickinson, N. Y.
	Frank D. Lyon	Binghamton, N. Y.
	Hon. Jos. H. Brownell.	Binghamton, N. Y.
Cayuga	Ernest G. Tabor	Meridian, N. Y.
	Wm. C. Richardson	Union Springs, N. Y.
	J. P. Nye	Auburn, N. Y.
Chemung	Charles T. Chamberlain	Elmira, N. Y.
	John J. Crowley	Elmira, N. Y.
	John T. Murtaugh	Elmira, N. Y.
	M. T. Simseen	Elmira, N. Y.
	Cooley D. Shappee	Elmira, N. Y.
Chenango	W. B. Leach	Norwich, N. Y.
	Geo. L. Page	Greene, N. Y.
	Isaac Dalrymple	Otselic, N. Y.
	Lester D. Smith	Norwich, N. Y.
Columbia	Erastus Hann	Germantown, N. Y.
	Geo. M. Bullock	Hillsdale, N. Y.
	Obiel Finch	Ancram, N. Y.
Cortland	W. F. Webb	Cortland, N. Y.
Dutchess	David V. Moore	Clove Valley, N. Y.
	Reginald W. Rivers	New Hamburgh, N. Y.
	Clinton J. Rockefeller	Madalin, N. Y.
Erie	Wm. H. Conboy	884 Ellicott Sq., Buffalo.
	Fayette Kelly	822 Ellicott Sq., Buffalo.
	Geo. C. Diehl	Ellicott Sq., Buffalo.
	James Menzies	Mut. Life Bld., Buffalo.
	Charles Brown	Ebenezer, N. Y.
	Frank E. Murphy	
	James B. Hoff	
Fulton	S. Elmore Burton	Gloversville, N. Y.
	Geo. E. Christie	Mayfield, N. Y.
	Joseph Sherman	Pine Lake, N. Y.
	Michael Heagle	Johnstown, N. Y.
	P. M. Simmons	Johnstown, N. Y.
Franklin	Wm. T. O'Neil	St. Regis Falls, N. Y.
	Wm. Johnston, Jr.	Chateaugay, N. Y.
	O. S. Lawrence	North Bangor, N. Y.

County.	Delegates	P. O. address.
Greene	Elmer Kruger	Prattsville, N. Y.
	Chas. Mackey	Coxsackie, N. Y.
	Henry I. Van Loan	Athens, N. Y.
Genesee	J. W. White	Byron Center, N. Y.
	J. W. Mullen	Morganville, N. Y.
Herkimer	Thomas Warren	Columbia, N. Y.
	Chas. Fellows	Newport, N. Y.
	Thos. Williams	Richford, N. Y.
	C. E. Klock	Little Falls, N. Y.
Jefferson	John M. Fitzgerald	Sacketts Harbor, N. Y.
	Fred Howland	Black River, N. Y.
Lewis	Seth E. Bullock	Osceola, N. Y.
	Nicholas Ossout	Watson, N. Y.
	C. E. Putnam	Croghan, N. Y.
Monroe	De Witt C. Becker	Fairport, N. Y.
	John Sutphin	Brockport, N. Y.
	Frank F. Jones	Webster, N. Y.
	Geo. H. Smith	Rochester, N. Y.
Nassau	Smith Cox	Freeport, N. Y.
	Edwin C. Willets	Mineola, N. Y.
	Wm. H. Jones	Woodbury, N. Y.
Niagara	John S. Reardon	Niagara Falls, N. Y.
	H. Seymour Ransom	Ransomville, N. Y.
	George N. Potter	Somerset, N. Y.
Orange	Hon. Louis F. Goodsell	Highland Falls, N. Y.
	Geo. Moshier	Newburgh, N. Y.
	John I. Bradley	Middletown, N. Y.
	J. E. Ward	
	I. H. Loughran	
	Geo. Fredericks	
Orleans	Chas. W. Glidden	Clarandon, N. Y.
	Weston Wetherbee	Barre Center, N. Y.
	Avery A. Donalds	Medina, N. Y.
	Gurden W. Fitch	Albion, N. Y.
Otsego	Lee Kinne	Hartwick Sem'ary, N.Y.
	M. C. Hemstreet	Oneonta, N. Y.
Oneida	Chas. Harden	McConnellsville, N. Y.
	John T. Phalan	Utica, N. Y.
	Fred M. Schell	Dudley Av., Utica, N.Y.
	Wm. Pierpont White	Utica, N. Y.
	Wm. Walsh	Utica, N. Y.
	Jno. Leighton	Utica, N. Y.
Onondaga	Frank Z. Wilcox	Syracuse, N. Y.
	F. M. Power	Solvay, N. Y.
	Wm. H. Gorham	Camillus, N. Y.
Putnam	Henry Mabie	Patterson, N. Y.
	Emmerson Clark	Lake Mahopac, N. Y.
	Wright E. Perry	Cold Spring, N. Y.
Rensselaer	Duane H. Newton	Stephent'n Center, N.Y.
	Edward B. Ames	Brainard Station, N. Y.
Rockland	A. V. H. Clark	Nanuet, N. Y.
	Josiah Felter	Haverstraw, N. Y.
	James Van Weelden	Nyack, N. Y.
	Frank S. Harris	Suffern, N. Y.
	Alex Rose	Stony Point, N. Y.
Seneca	Chas. S. Farr	Lodi, N. Y.
	Wm. B. Wells	Ovid, N. Y.
	Chas. W. Cosad	Cosad, N. Y.

County.	Delegates.	P. O. address.
Schoharie	D. W. Jenkins	Central Bridge, N. Y.
	O. Spickerman	West Fulton, N. Y.
	Harlem P. Ives	Richmondville, N. Y.
Saratoga	L. S. Sherman	So. Glens Falls, N. Y.
	H. C. Denton	Day, N. Y.
	M. L. Katham	Hadley, N. Y.
Schuyler	Elmer Sherwood	Odessa, N. Y.
Schenectady	James B. Houck	Scotia, N. Y.
	G. W. Freligh	Niskayuna, N. Y.
	Walter Bradshaw	Princetown, N. Y.
	Alanson Robison	Rotterdam, N. Y.
Tompkins	J. L. Mandeville	Caroline, N. Y.
Ulster	Simon B. Van Wagonen	Port Ewen, N. Y.
	James McMillin	Brodhead, N. Y.
	Henry McNamee	Fly Mountain, N. Y.
	A. S. Denton	Gardiner, N. Y.
Westchester	Joseph B. See	Valhalla, N. Y.
	James P. Teed	Somers Center, N. Y.
	Stephen Vantassel	Mt. Vernon, N. Y.
Washington	John J. Morgan	Fort Edward, N. Y.
	F. E. Kenyon	Cen. White Creek, N.Y.
	R. E. Warren	Hampton, N. Y.
Wayne	Jemain Andrew	Walworth, N. Y.
	S. B. Dean	Marion, N. Y.
	J. T. Pearsall	Sodus, N. Y.
St. Lawrence	Hon. Chas. S. Plank	Waddington, N. Y.

The Convention was called to order by Hon. Edward A. Bond, State Engineer and Surveyor, who was unanimously chosen as temporary chairman, and Mr. John J. Crowley of Chemung county, temporary secretary.

On motion of Mr. See of Westchester county, the Chair appointed the following Committee on Permanent Organization:

Messrs. See of Westchester, Potter of Niagara, Fitch of Orleans, Conboy of Erie, Brownell of Broome, Mosher of Orange, Van Wagoner of Ulster, Chamberlain of Chemung, Lawrence of Franklin, and Leach of Chenango.

On motion of Mr. See of Westchester county, a recess of twenty minutes was taken.

At 11:35 a. m. the Convention reconvened.

The Committee on Permanent Organization reported as follows:

Permanent Chairman, George H. Smith of Monroe.

Permanent Secretary, John J. Crowley of Chemung.

Vice-Presidents—Mr. Wilcox of Onondaga and Mr. Glidden of Orleans.

Committee on Business—Messrs. Wilcox of Onondaga, Ward of Orange, Potter of Niagara, Lyon of Broome, and Hopkins of Westchester.

Committee on Legislation—The Hon. Louis Goodsell of Orange and Messrs. Murtaugh of Chemung, Fitch of Orleans, Murphy of Erie and Robinson of Schenectady. There were afterwards added to this Committee Wm. P. White, Esq., of Oneida county and Frank L. Wilcox of Onondaga county.

Committee on Resolutions—Messrs. Lawrence of Franklin, McNamee of Ulster, Mable of Putnam, Dalrymple of Chenango and Bedell of Albany.

Committee to Wait on Governor—Mr. Bond, chairman; Messrs. See of Westchester, White of Genesee, Cox of Nassau, Clark of Rockland, Conboy

of Erie, Fitzgerald of Jefferson, Plank of St. Lawrence, Moore of Dutchess and Longhran of Orange.

The report of the committee was unanimously adopted.

A committee of two was appointed to conduct Mr. Smith to the chair.

Permanent Chairman Smith took the chair and thanked the Convention for the honor conferred upon him.

On motion of Mr. Lawrence of Franklin county, Hon. Edward A. Bond was made a member of the Convention.

Moved by Mr. Lawrence of Franklin, that the members of this Convention call upon the Governor and that the Chairman be selected as spokesman for the convention and present our requests at the hearing to be given by the Governor. Carried.

At the request of the Chairman, State Engineer Bond addressed the Convention, outlining the progress which had been made in the improvement of public highways under chapter 115 of the Laws of 1898, known as the "Higbie-Armstrong Law."

Mr. Lyons of Broome county moved that we request the Governor and Legislature for an appropriation of at least $1,000,000 for highway purposes.

Mr. See of Westchester and a number of other delegates addressed the Convention and urged the adoption of the above resolution.

Mr. Wilcox of Onondaga offered as an amendment that the sum be fixed at $750,000. Amendment lost.

The vote recurring on the original resolution, the same was adopted.

On motion, the Convention adjourned until 2:30 p. m.

After the adjournment, the delegates waited upon Governor Odell. Chairman Smith, on behalf of the delegates, presented in an able manner the various arguments advanced by the Convention in behalf of a large appropriation for highway improvement, to which the Governor replied that the matter would receive the consideration which its importance warranted.

AFTERNOON SESSION—2:30 P. M.

Convention met, pursuant to adjournment, with Mr. Smith in the chair.

Chairman Smith suggested that the standing committee appointed at the morning session meet and organize.

On motion of Mr. Murphy of Erie county, Mr. Wm. P. White of Oneida county was added to the Committee on Legislation.

Mr. Walsh of Oneida county offered the following resolution:

"*Resolved*, That the rebate allowed by law for the using of wide tires be abolished by act of the Legislature."

Mr. Walsh addressed the Convention and urged the adoption of the resolution.

Mr. Conboy of Erie county moved that the resolution be referred to the Committee on Legislation. Motion carried.

On motion, the Convention took a recess of fifteen minutes for the purpose of giving time to the committees to meet and organize.

At 3:15 p. m. the Convention reconvened.

Mr. Longhran of Orange county moved that the roll of counties be called for the purpose of ascertaining how many towns in the State had adopted the money system in improving their highways. Motion carried.

The Secretary called the roll of the several counties, and it was ascertained that 93 towns in 22 counties had adopted the money tax system.

Several delegates from different counties stated to the Convention that the matter was under consideration in their respective counties, and it would be voted on at their next town meeting.

Mr. Wilcox of Onondaga county addressed the Convention on the working of the money system in Oneida county and explained the benefit to be derived therefrom.

Mr. Longhran of Orange explained the benefit of the money system in Orange county, and expressed the opinion that he thought the adoption of this system was one of the solutions of the question of good roads.

Mr. White of Oneida county, in the absence of Mr. Goodsell, was requested by the Committee on Legislation to briefly lay out the line of action suggested by the committee. He spoke in part as follows:

" Would it not be feasible for the representatives of the different Boards of Supervisors assembled at Albany to agree on a committee, possibly of five, possibly of fifteen? the number is for discussion. This committee ought to represent the sentiment of good roads work in the different counties and the different counties should be represented according to road work done according to location. The duties of the committee would be to run down to Albany and confer with members having bills for road improvement for the purpose of directing intelligent road legislation and for the purpose of getting a sufficient appropriation of money to carry on highway improvement." He suggested that the county sending the representative should bear the expense of the representative.

He asked for the best thought of the Convention on the subject, and stated it would be called up for discussion to-morrow morning.

Mr. Conboy stated that Erie county had such a committee, and that they had appeared before the committees at Albany three or four times last year.

Mr. Wilcox of Onondaga county also addressed the Convention, and offered the following resolution and moved its adoption:

Resolved, That this Convention recommend the adoption by all the towns of the State of the money system for the repair and maintenance of the highways under their control.

Mr. Cosad of Seneca county addressed the Convention and spoke in favor of the labor system.

Mr. White of Oneida county spoke in favor of the money system.

Mr. Bond presented the following statement of rebate allowed by the State in 1900 to towns under the Fuller Law:

1900.

Rebate under Fuller Law—Highway Taxes, Chap. 351, Laws 1898.

County.	Number of towns.	Amount levied.	State's 25 per cent.
Albany	1	$4,511 00	$1,127 75
Chautauqua	1	1,500 00	375 00
Chenango	4	3,472 70	868 17
Columbia	3	4,317 00	1,079 25
Cortland	1	650 00	162 50
Dutchess	13	32,723 73	8,180 93
Erie	2	11,535 00	2,883 75
Greene	2	6,000 00	1,189 32
Madison	5	4,298 86	1,074 71
Hamilton	5	6,282 25	1,570 56
Oneida	4	6,687 86	1,671 96
Onondaga	9	14,585 07	3,646 27
Orange	7	17,845 48	4,461 37
Rensselaer	1	2,300 00	575 00
Rockland	5	21,974 54	5,493 38
Saratoga	1	1,000 00	250 00
Suffolk	6	49,762 17	12,440 79
Tompkins	1	1,592 51	398 13
Ulster	1	4,300 00	1,075 00
Westchester	15	60,313 96	15,078 49
Totals	87	$257,052 13	$63,751 09

The above amount, $63,751.09, will be distributed among the counties during May and June, 1901.

Mr. Cosad of Seneca read an article from a newspaper to the Convention showing the sentiment in his county.

Mr. Cox of Nassau explained the difference between gravel and stone roads. He said the people of his county never regretted the building of the good roads in his county. He said it had increased the number of their inhabitants and increased the valuation of property.

Mr. Wilcox of Onondaga county moved the adoption of this resolution. Carried.

Mr. Conboy of Erie offered the following resolution, which was adopted:

Resolved, That we recommend to the Legislature an amendment of the Fuller Law so that the supervisors of the different counties can adopt for their counties the cash system and still receive the 25 per cent. State aid for the cash system.

Mr. Conboy of Erie county moved that a committee of two be appointed by the Chairman to attend to the drafting of such a bill.

Mr. See of Westchester moved as an amendment to strike out the word "two" and substitute therefor the Committee on Legislation.

The amendment was lost: 39 nays and 30 ayes. Vote recurring on the original resolution, the same was adopted.

Mr. Bond moved that Hon. J. L. Smith of Lewis county be requested to address the Convention in relation to his bill introduced in the Legislature. Carried.

Mr. Smith addressed the Convention in favor of good roads. His bill provides for assistance to towns in the purchase of appliances for crushing stone. His bill provides if the town votes to raise one-fourth of the required amount, the county must raise one-fourth and the State one-half.

On motion of Mr. White of Oneida county, Mr. Wilcox of Onondaga was added to the Committee on Legislation. Carried.

The question of maintenance of highways constructed under the Higbie-Armstrong Law, after the completion thereof, was referred to the Committee on Legislation.

On motion of Mr. Lyon of Broome, the Convention adjourned until to-morrow at 10:30 a. m.

FRIDAY, FEBRUARY 15TH—MORNING SESSION, 10 A. M.

Convention met, pursuant to adjournment, with Mr. Smith in the chair.

The journal of the previous sessions of the Convention was then read and approved.

The Chairman announced the following committee under Mr. Conboy's resolution of yesterday in relation to the drafting of a bill for presentation to the Legislature:

Mr. Conboy of Erie and Mr. White of Oneida.

Mr. White of Oneida county, of the Committee on Legislation, in the absence of Mr. Goodsell, presented the following report of the Committee on Legislation:

"*Resolved*, That for the purpose of creating a permanent annual committee to represent the Boards of Supervisors of the State of New York on all matters pretaining to road legislation, and the appropriation of money for carrying the same into effect, we, the delegates from our boards of supervisors, representing at this Convention forty counties of New York State, do hereby constitute

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such a committee, and we hereby request the boards of supervisors of the respective counties, in addition to our appointment of said committee, to ratify the appointment of their respective committeemen and provide their necessary expenses and disbursements.

"Any three of the committeemen, when present at a meeting, may act, provided they are unanimous in their action, or a majority of those present. Vacancies may be filled by any board of supervisors on request from the State Engineer. Each judicial district shall be entitled to two committeemen."

Mr. White moved the adoption of the report of the committee. Motion carried.

Mr. Sherman of Saratoga county moved that the matter of selecting members of the permanent standing committee by the delegates from the different judicial districts be deferred until the close of this morning's session. Carried.

The Chairman announced the presence of two gentlemen from Massachusetts who are intimately connected with the subject of highway improvement in their state, Hon. William E. McClintock, chairman of the Massachusetts Highway Commission, and Mr. Charles Mills, chief engineer of the Commission.

On motion of Mr. Bond, Hon. William E. McClintock, chairman of the Massachusetts Highway Commission, was invited to address the Convention.

Mr. McClintock addressed the Convention. He gave an able discussion of the question of highway improvements in his state, and related the history of good road legislation in Massachusetts.

Mr. Lyons of Broome county moved that the State Engineer, with the assistance of the Standing Committee, be requested to prepare a pamphlet and circular letter. Motion carried.

Mr. Bullock of Columbia county offered the following resolution, and, on motion of Mr. Wilcox, the same was referred to the Committee on Legislation:

"*Resolved*, That we do most heartily approve of Assembly bill No. 858, introduced by Sanford W. Smith, entitled "An act to amend the County Law in relation to the power of boards of supervisors to regulate the speed of vehicles upon highways," as a measure in the interest of the safety and comfort of persons using the highways of the State.

"*Resolved*, That a copy of these resolutions be transmitted by the Secretary to the Speaker of the Assembly, the President of the Senate, and the chairman of the Senate and Assembly Committees on Internal Affairs."

Mr. White of the Committee on Legislation reported the following recommendations of said committee:

1. The committee reports against Mr. Walsh's resolution asking for an amendment to the wide tire bill.

2. Recommend the passage of a bill which shall expedite and cheapen condemnation proceedings in connection with highway improvements.

Mr. Conboy of Erie county moved that the recommendations be taken up seriatim. Motion carried.

The Convention took up the first recommendation of the committee, and, on motion, the report of the committee was adopted.

The Convention took up the second recommendation of the committee, and, on motion, the same was adopted.

Chairman Smith announced that the lecture, accompanied by stereopticon views, would commence promptly at 4 o'clock.

On motion of Mr. Lyons of Broome county, the question of prison labor in connection with highway improvement was made a special order for the afternoon session.

Mr. Wilcox of Onondaga county offered the following resolution:

"*Resolved*, That all moneys raised in the several towns of this State in which the money system prevails should be expended by the commissioner of highways under the direction of the town board."

Messrs. White of Oneida, Chamberlain of Chemung, and others, spoke in opposition to the resolution.

On motion of Mr. Lyons of Broome county, the resolution was referred to the committee to be appointed from the different judicial districts.

At 12:45 p. m. the Convention took a recess until 2 p. m.

Convention reassembled at 2 p. m.

Mr. Lyons of Broome county took up the special order in regard to the employment of prison labor in highway improvements.

Mr. White and others spoke in favor of the employment of prison labor.

Mr. See of Westchester and others spoke in opposition to the employment of prison labor on highways.

On motion of Mr. White, the special order was closed.

The following named gentlemen were selected as members of the Standing Committee by the delegates from the several judicial districts in accordance with the resolution of this morning:

Name.	Judicial district.	Residence.
Albert R. Shattuck....	First	New York City.
Edward A. Bond.....:	Fifth	Watertown, N. Y.
Joseph B. See.........	Second	Valhalla, N. Y.
R. W. Rives...........	Second	New Hamburgh, N. Y.
Edward J. Bedell.....	Third	Selkirk, N. Y.
Henry McNamee	Third	Fly Mountain, Ulster Co., N. Y.
Edgar T. Brackett.....	Fourth	Saratoga, N. Y.
F. D. Kilburn..........	Fourth	Malone, N. Y.
Frank Z. Wilcox......	Fifth	Syracuse, N. Y.
Wm. Pierrepont White:	Fifth	Utica, N. Y.
Joseph H. Brownell...	Sixth	Windsor, Broome Co., N. Y.
Charles F. Chamberlain	Sixth	Elmira, N. Y.
W. W. Armstrong.....	Seventh	Rochester, N. Y.
Charles S. Farr........	Seventh	Lodi, Seneca Co., N. Y.
Wm. J. Conboy........	Eighth	Buffalo, N. Y.
Weston Weatherby....	Eighth	Orleans Co., N. Y.

Mr. White of Oneida county moved that the above names submitted by the different delegations be inserted in the resolution of the Committee on Legislation presented this morning. Motion carried.

Mr. Lyons of Broome county moved that this Convention express its satisfaction with the manner in which State Engineer Bond and his assistants have conducted the work of highway construction in New York State. Motion carried.

The Committee on Resolutions reported and recommended the adoption of the following resolutions:

1. *Resolved*, That this Convention strongly recommend the passage of the so-called Plank bill.

2. *Resolved*, That the Attorney-General's office be called upon to enforce the present Labor Law through the district attorneys of the various counties.

3. *Resolved,* That we ask the Legislature to appropriate $1,000,000 to carry out the provisions of the Higbie-Armstrong act.

4. *Resolved,* That we heartily approve of the efforts being made to employ convict labor in the construction of roads.

5. *Resolved,* That the thanks of this Convention be extended to D. E. Pugh, superintendent of the City Hall of Albany, for the use of the rooms in which this Convention has been held.

6. *Resolved,* That the thanks of this Convention be extended to Hon. Edward A. Bond for the instructive program which he devised and which has been carried out, thereby giving an opportunity for an exchange of ideas, which must ultimately result beneficially to the success of the cause in which we are engaged.

7. *Resolved,* That the thanks of the Convention be extended to Mr. Smith of Monroe for the able and courteous manner in which he has presided over our deliberations, and also to the Secretary, Mr. Crowley, for the arduous task which he has so accurately performed.

8. *Resolved,* That the thanks of the Convention be extended to the Hon. William E. McClintock, chairman of the Massachusetts Highway Commission, for his able and instructive address to the Convention.

The question of the adoption of the report of the Committee on Resolutions being before the Convention, there was some inquiry as to the first resolution indorsing the so-called Plank bill.

Assemblyman Plank, being present, was given the privilege of the floor and explained to the Convention the nature of the Plank bill. He stated it was an amendment to the Fuller Law, and raised from 25 per cent. to 50 per cent. the State share in towns adopting the money system.

Mr. Mosher moved that the several resolutions be acted on separately. Motion carried.

The question of the adoption of the first resolution being before the Convention, Mr. Conboy moved that said resolution be laid on the table. Motion to lay on table lost by vote.

The vote recurring on the resolution, the same was lost.

The second resolution reported by the committee being before the Convention, Mr. Rives of Dutchess county moved to amend by inserting after the word "Labor Law" the words "as applies to highways." Amendment carried.

Vote recurring on the original resolution as amended, the same was adopted.

The third resolution being before the Convention, Mr. Mosher moved to amend so that the resolution will read "At least one million dollars."

Mr. See of Westchester raised the point of order that this resolution had already been adopted by this Convention.

The Chairman ruled the point of order well taken.

The fourth resolution then being before the Convention, the same was adopted.

The fifth resolution then being before the Convention, the same was adopted.

The sixth resolution then being before the Convention, the same was adopted.

The seventh resolution then being before the Convention, having been stated by Mr. Wilcox, the same was adopted.

The eighth resolution then being before the Convention, the same was adopted.

Mr. Conboy of Erie extended an invitation to the delegates to attend the Pan-American Exposition at the expense of Erie county.

On motion of Mr. Menzies of Erie, the Chairman, Mr. Smith, was added to the Permanent Committee.

On motion of Mr. White, all unfinished business was referred to the Standing Committee.

On motion of Mr. White, the Chairman was instructed to call a meeting of the Standing Committee immediately after adjournment.

On motion of Mr. Wilcox of Onondaga, the Convention at 4 p. m. adjourned sine die.

ILLUSTRATED LECTURE.

The convention was followed by an illustrated lecture on improved highways, which was given, by Mr. H. B. Fullerton, of Brooklyn, to a large audience composed of delegates of the convention and members of the Legislature and others.

The superb collection of stereopticon views was accompanied by a very interesting lecture by Mr. Fullerton. The views showed good roads and bad roads here and abroad; among the best views of good roads were a number showing some of the new roads built during 1899 and 1900 by the State Engineer department of New York State.

It was a source of much gratification to see that these roads compared favorably with the best which were shown, either in this country or abroad.

It was the unanimous opinion of those who saw the views and heard the lecture with which Mr. Fullerton accompanied it, that it would convert many opponents of good roads construction if Mr. Fullerton could visit the various counties of the State with these views, and this Mr. Fullerton (who represents the Good Roads Association of New York State, and whose address is Long Island City, N. Y.) is ready to do when requested.

ROAD NO. ....

HIGHWAY IMPROVEMENT

STATE OF NEW YORK

Chapter 115, Laws of 1898

SPECIFICATIONS.

DESCRIPTION OF THE ROAD TO BE IMPROVED.

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WORK TO BE DONE.

The work to be done under these specifications will consist of grading the road to the established grade lines, constructing the necessary drains, ditches and culverts, and laying a six-inch macadam surface............ feet wide, and all other work necessary for the proper fulfillment of the contract, according to the meaning and intent of the plans and specifications, which plans are a part hereof. The lump sum named in the contract will cover the cost of all the work and materials necessary for completion.

The contractor will be required to do all the clearing and grubbing, all excavation and embankment, all levelling, ditching, grading and surfacing, all masonry and stonework, and to furnish all materials for the same; to build all waterways, drains, driveways and culverts; to clear away all rubbish which may obstruct the roadway or the water-ways; to protect all fences and to repair or replace the same if they become damaged or destroyed by him or by his employees. In short, he will be required to furnish all the materials, implements and labor required to build and put in complete order for use, the said.................miles of road. He will be required to remove from the road and from adjoining property all rubbish and surplus materials pertaining to the work, which may have accumulated during its prosecution.

The whole work must be conducted and completed to the satisfaction of the State Engineer and Surveyor.

GRUBBING AND CLEARING.

Where directed by the Engineer, all trees, brush and undergrowth shall be removed from the entire area included within the right of way. All fencing material shall be carefully removed and deposited, and all trees, stumps, brush, sod and roots within the lines of the improvement shall be grubbed and removed, as the Engineer may direct. All wood and brush thus removed except fencing material shall be burned or removed from the ground without damage to the adjoining property.

EXCAVATION.

The roadway and ditches shall be graded throughout the entire length to the width of...........feet between ditches or to conform to the lines and grades, as shown on the plans, and as given by the Engineer, and side slopes and waste material along road shall be graded or leveled.

All boulders or stumps shall be excavated to a depth of at least six inches below subgrade. Wherever such materials have been excavated, a sufficient amount of material, approved by the Engineer, shall be furnished and placed so as to make the surface conform to the required subgrade.

The contractor shall excavate such drainage ditches as the Engineer may direct, provided that the total amount of material excavated does not exceed the total quantity of excavation shown in the plans and specifications.

If unstable, sand, soft clay, dust or mud, spongy material or vegetable matter is found in the roadbed, it shall be removed to such depth as may be required by the Engineer and replaced by sufficient gravel, sand or loam, approved by the Engineer, to make a firm and stable foundation conforming to the required grade.

Where there is sod, or a hard smooth surface upon the original surface of the ground, it shall be thoroughly broken up and all sod and vegetable matter removed before any embankment is formed thereon, so as to form a proper bond with the new materials.

Embankments shall be formed of earth or other materials which are satisfactory to the Engineer, and shall be free from vegetable matter or refuse of any kind; Or if the embankment is formed of stone, as may be the case when material from a rock cut is used, this shall be carefully placed and all spaces completely filled with sand, earth or gravel so as to form a solid embankment free from voids.

All embankments shall have side slopes as shown upon the plans, but in no case shall slopes be steeper than the "angle of repose" of the material and no large stones or boulders shall be left on the surface of the slopes but shall be put at the base of the embankment. Embankments shall be constructed in successive layers not exceeding 6 inches in thickness, and each layer shall be thoroughly rolled. The rolling shall be continued during the making of the embankment and until the Engineer directs it to be stopped. All embankments must be sprinkled while rolling them as the Engineer directs.

Surplus excavation shall be used to widen embankments or in such other places as the Engineer may direct.

All sections and slopes shall be left with [illegible] surfaces, and in [illegible] given by the Engineer. To insure [illegible] required by the [illegible]

[illegible]

[illegible] of the road farthest from [illegible]

[illegible] before [illegible] and [illegible]

weighing about ten (10) tons and so built that it shall exert a pressure of about 500 pounds to the linear inch, measured across face of rollers. All hollows and depressions developed during the rolling shall be filled with material acceptable to the Engineer, and the rolling shall be continued until no depressions can be formed with the roller. The shoulders also shall be thoroughly rolled, using a lighter roller in cases where the character of material makes it unsafe for a 10-ton roller to go on the shoulders.

When the subgrade or shoulders consist of unstable material too great in extent to be removed and which will not consolidate under action of roller, this shall be formed to the desired shape and then treated in such manner as may be necessary to consolidate and compact it with the roller. Such means shall be used as the character of the material which is found in the roadbed may require to give the best results in affording a stable bed for the bottom course while rolling and binding it.

The expense of all such special work, should it be required, must be borne by the contractor and must be considered by him in making his proposal.

The bottom course shall not be placed on this subgrade until the latter has been accepted by the Engineer.

UNDERDRAINS AND CULVERTS—VITRIFIED PIPE, POROUS TILE AND CAST IRON PIPE.

Lateral underdrains shall be provided on one or both sides of the road equal to the amounts named on the quantity sheet, at places where shown on the plans, or where required by the Engineer. (See " Culverts " of these specifications.)

The trench for the drain, 2 to 4 feet deep, shall be dug to the line and grade furnished by the Engineer. The bottom shall be covered with two or more inches of sand or gravel or gravelly earth. The minimum slope for lateral drains shall be two-tenths of a foot per hundred feet.

Vitrified Tile. These shall be of 4-inch, 5-inch or 6-inch diameter of opening as shown, salt glazed, second quality, free from defects impairing their strength.

Each length of pipe shall be laid with the bell upstream and no chipping shall be allowed to insert spigot-end into bell. The lower one-third of each joint shall be filled with mortar formed of equal parts of American Portland cement and sand; the upper two-thirds of the bell shall be filled with a roll of oakum, pushed in after pipe is laid. The pipe shall be covered as laid, with 12 inches or more of clean gravel or stone placed around and over it, and the trench shall then be filled with the best available material, not clay, all being thoroughly tamped with a thin iron rammer. During the laying of the pipe, and until the completion of the drain, there shall be kept inside of the drain a close-fitting bunch of burlap fastened securely around the end of a 4-foot handle; this shall be drawn forward as each joint is added in order to remove any mortar which may project inward at the joints, and to prevent any stones or other obstructions from being left within the drain.

Porous Tile may be used, when so shown on the plans, for the shorter side drains or for transverse drains; where so used, the tile must be cylindrical, of first quality, well-burnt, cherry color, straight, sound and free from defects impairing strength. The trench must be fitted to

receive the tile by cutting its bottom accurately to grade and 12 inches wide. The ends of the tile shall be laid in close contact, and each joint shall be covered with a piece of burlap 12 inches square, folded twice, or by a strip of burlap 6 inches wide and long enough to wrap one and one-half times around the pipe, giving double thickness on the top half. The trench shall be filled as provided above for laying vitrified underdrain pipe.

Cast Iron Pipe for culverts may be of a second quality, free from defects impairing their strength, but must be cast in dry sand moulds placed vertically, and truly centered. The iron must be of good quality, uniform in thickness and full strength, coated with coal-pitch varnish mixed with linseed oil to form a firm tough coating. The joint shall be made by placing a gasket of oakum, and filling hub with mortar formed of equal parts of American Portland cement and clean sharp sand.

BROKEN STONE.

The contractor shall be required to submit with his bid a written statement of the quarries or ledges or other sources of supply from which he proposes to obtain the stone for the road.

If the proposed quarries are fully developed and uniform ones, furnishing a product which is satisfactory to the State Engineer, this will be accepted by the State Engineer and the contractor will be so informed.

If the proposed quarries or ledges or other sources of supply are not fully developed, or are not uniform, or if for any reason the product proves to be unsatisfactory to the State Engineer, he may decline to continue its use and may require the development of other quarries or the provision of other sources of supply and the contractor shall have no claim for increased payment on account of such requirement.

As soon as the crusher is in operation, the contractor shall furnish to the engineer in local charge, named by the State Engineer, a sample consisting of one-half of a cubic foot of each size of the crushed stone ready for use, showing approved character and size. All stone which the engineer shall consider to be inferior in quality or size to these samples will be rejected.

QUALITY OF BROKEN STONE.

The broken stone and screenings must be of hard and compact texture and of uniform grain. The stone must be broken as nearly cubical as possible, and screened through a rotary screen which will produce stone of the sizes herein specified, having rough surfaces obtained by fracture. Water-worn pebbles will not be accepted. Disintegrated and weather-worn stone from the surface of a quarry will not be accepted. The stone for the different courses must be thoroughly cleaned before crushing and well screened, clean and free from injurious matter of every nature.

KIND AND SIZES OF BROKEN STONE AND SCREENINGS.

The broken stone shall be spread in two courses. The bottom course shall be of the required thickness shown on plans after rolling and may consist of approved trap rock, granite, gneiss or any of the harder grades of limestone or tough sandstone, broken in sizes varying from a minimum of 2 inches to a maximum of 3 inches in their longest dimensions. Included in this bottom course, but not exceeding one-third of it, may be

the one-half inch to 2 inch product of the crusher, spread in a uniform layer over the surface of the subgrade.

The top course shall be of the required thickness after rolling and shall consist of .... broken in sizes varying from a minimum of 1 inch to a maximum of 2 inches in their longest dimensions.

Limestone screenings may be required if so specified in quantity sheet, but screenings of local or other crushed stone, or clean sand, may be used if so specified in the quantity sheet or in case the State Engineer so decides, provided that the cost is not increased thereby.

Screenings shall not exceed one-half inch in size and shall be free from earth, loam, or vegetable matter and shall contain all the dust of fracture.

SPREADING AND ROLLING.

After the earth subgrade has been completed as specified and has passed the inspection of the Engineer, a layer of broken stone of the size and quality hereinbefore specified for the bottom course and of such depth as will when rolled, make a course of the required thickness, shall be spread evenly over the prepared subgrade, using preferably wide-tired wagons therefor; the depth of the loose stone in this layer being fixed by laying upon the subgrade cubical blocks of wood of the desired size. The roller shall then be run first along the edge of the stone, lapping upon the shoulder about 6 inches and going backward and forward several times on each side before rolling the center. The lower course should be rolled until the stones do not creep or weave ahead of the roller. Screenings shall be dumped in piles at proper intervals along the side of the roadway upon the wings, or may be shoveled from a wagon or cart. In no case shall the screenings be dumped directly in mass upon the crushed stone, but they shall be spread uniformly to a depth of one-half inch by shovels from the piles or wagons. The screenings shall then be rolled dry and swept with rattan or steel brooms until they have nearly all disappeared when another coat of screenings shall be spread and rolled and swept, adding more screenings, if necessary, until no more will go in dry, when the surface shall, if required by the Engineer, be wet with a sprinkler, using water freely, until all the voids are filled, leaving the surface free from screenings in all places.

Sprinkler. The sprinkler shall have at least 6-inch tires on its wheels which shall be on axles of unequal length, mounted without a reach to allow short turns.

The top course of stone shall then be spread, using cubical blocks of wood to fix the depth and preserving the grade and crown as described for the bottom course. The top course shall then be rolled until the stones do not creep or weave and shall then be covered with dry screenings about 1 inch deep and rolled and swept dry, as before described, after which the road shall be saturated with water, following with roller; sufficient amount of water shall be put on to fill all of the voids or until it shows on the surface, when the rolling shall continue until a grout has been formed of the screenings, stone-dust and water. After this grout has filled all the voids, it will appear on the surface in patches.

The rolling shall continue until this grout can be pushed in a wave

before the wheels of the roller. Filler and binder shall fill all interstices of the broken stone in both courses, as above described, and shall cover the surface of metal when completed.

During the progress of the rolling and sprinkling, the binder shall be swept about with brooms of rattan or steel to facilitate the thorough filling of the interstices and the screenings will in many places work down into the voids of the stone, leaving none on top. A second coat of screenings shall then be spread on these spots wherever needed, and a second "puddle" shall be made, using a cart or wagon for carrying the supply of screenings. After the wave of grout has been produced over the whole section of the road, screenings or approved coarse sand shall be spread where required to leave them three-eighths of an inch deep for a wearing surface, which shall be maintained and renewed if necessary until the whole road has been accepted.

This portion of the road shall then be left to dry, when it shall be opened to travel.

As soon as any portion shall have been completed in compliance with these specifications and has dried as described and has been opened for travel, it shall be thoroughly sprinkled at least once a day for thirty days. If at any time before the final acceptance it is the opinion of the Engineer that a better result can be obtained by going back on the finished work with the roller or sprinkler, or both, this shall be done. Rainy days shall be devoted to rolling the finished work where required.

METHOD OF CARRYING ON THE WORK.

The work shall all be carried along together where practicable. Each course shall be rolled and filled promptly after spreading, and travel upon the loose stone shall be prevented.

No allowance will be made for any material driven into the subgrade by rolling, or for any mistake made by contractor in excavating or filling. The use of proper rollers, rammers or other suitable implements, shall be substituted for that of the steam roller when the Engineer so directs.

EXTRA MATERIAL FOR MAINTENANCE.

Where called for in the estimate of quantities, in addition to the crushed stone for the top course and the screenings used in the work above described, there shall be also provided sufficient quantities of each to form at intervals of 200 feet, piles of crushed stone for the top course and of screenings for filler, each pile to be about 3 feet by 6 feet and to be neatly formed at one side of road and to contain about one-half cubic yard of crushed stone for the top course and one half cubic yard of screenings, kept separate. These piles may be combined in one or more if so ordered.

MASONRY.

All masonry shall be laid in Portland cement mortar as specified below. All stone shall be sound, durable, well shaped quarry stone satisfactory to the Engineer. All masonry shall be third class unless some other class is called for on the plans, or in the Engineer's estimate of quantities.

The quantity of masonry mentioned in the specifications will be built where shown on the plans or elsewhere as required by the Division Engineer.

MORTAR.

Mortar will be classified as follows:

Class. No. 1, or Pointing Mortar. Made of one part of American Portland cement and one part of sand.

No. 2, or Special Mortar. Made of one part of American Portland cement and two parts of sand.

No. 3, or Standard Mortar. Made of one part of American Portland cement and three parts of sand.

Materials for Mortar. As follows:

Inspection. Cement and sand shall be subject to rigid inspection on the work and to prescribed tests made at the cement-testing laboratory of the State Engineer at Albany.

CEMENT.

Requirements Hydraulic Cement. American Portland cement shall be used and shall be of a brand known by prior use on extensive works to be of the best quality. Any cement not so known may be declined without testing.

Storing. Provision shall be made by the contractor for storing cement in a dry place and delivery shall not be made until the State Engineer has been notified to inspect the cement and to take samples for which all facilities shall be offered by the contractor. The contractor shall replace at his own cost any cement which may be damaged while stored.

Samples. Samples will be taken by the Engineer at once on delivery, from every tenth barrel or from the equivalent of the tenth barrel when packed in sacks, and will be numbered consecutively throughout the progress of the work; each sample shall fill a 3-inch cubical box, and each lot of samples shall be forwarded by express to Albany for separate tests, the results of which may be expected in ten days.

TESTS. These tests will follow the practice recommended by the American Society of Civil Engineers and will be: 1st, for fineness; 2d, for soundness; 3d, for time of initial set; 4th, for tensile strength; 5th, for composition by chemical tests.

SAND. Sand used for mortar shall be of the best quality available and shall be of the cleanest and sharpest found in the vicinity of the work.

Samples. The contractor shall inform the State Engineer, as soon as the contract is awarded, what sand is proposed to be used, and samples of this sand will be obtained by the Engineer and forwarded to Albany.

Tests. These samples will be examined and tested at the cement-testing laboratory at Albany and if found to contain an injurious amount of loam, or silt, or material that is friable or soluble, the contractor will be required to wash the sand before it is brought on the work.

Washing and Clearing. It will be the duty of the Engineer to see that the soil overlying the sand bank is cleared away so that no soil shall slide or wash into the sand during its use, and special care shall be taken that dirty sand shall not be used in making mortar.

MORTAR. Cement for concrete or for mortar shall not be used directly from any original package, but the contents of five packages shall first be mixed dry in order to obtain uniformity.

Mixing. The dry cement shall be measured by bulk as wanted and the specified proportions of dry sand shall also be measured by bulk in the mortar box where the dry cement shall be uniformly spread over it. The mixture shall then be made while dry, by turning with shovels or the Engineer may require that the dry sand and cement shall be screened as being the most effective and easiest way of securing a perfect mixture, of uniform color and without streaks, which will be required before adding water to make mortar, which shall be done gradually to avoid washing the cement away from the sand.

Quantity. The quantity of mortar made at each batch shall be no greater than will be used in 45 minutes after beginning to mix with water. If mortar has set at all before using, it shall not be retempered but shall be thrown away.

THIRD CLASS MASONRY.

MORTAR. No. 3 or "standard."

Courses. Regular or irregular broken, as may best suit the stones used, forming good substantial rubble masonry; selected stones shall be used at all angles or ends of walls.

Thickness. Least size 6 inches; least volume 2 cubic feet; smaller stones may be used for filling interstices in heart of wall.

Stretchers. Width. Least width equal to rise.

Headers. Shall form at least one-fourth of front and rear of wall.

Length. Least size, two and one-half times the rise.

Width of Bed. Least size equal to rise.

Cutting. Exposed faces shall be "rock-faced" with projections not more than 4 inches. No sharp projections of any size allowed. Stones shall be roughly squared on joints, beds and faces. No dog-holes in face.

Joints. Horizontal. Average not more than 1 inch.

Vertical. Average not more than 1 inch.

Bond. Bond of all stones in face, heart and back must be at least 6 inches.

Headers must come directly over stretchers in next lower course and between headers in next courses below and above, and between headers in front and rear of same course.

Backing. Projecting points shall be removed from top and bottom beds of all backing stones which shall be laid with good bearing, on broadest bed, in full bed of mortar into which small stones shall be pounded to fill all spaces. No grout will be used.

Bond. All backing stones must break joints and bond 6 inches or more.

Coping. As shown on plans formed of stone or first-class concrete.

Size. All stones shall be of uniform thickness for continuous lengths of not less than 30 feet. Each stone shall cover full width of wall, except when width exceeds 3 feet.

Cutting. Points projecting above general surface of top shall be removed.

Joints. Shall average not more than 1 inch.

Bond. Each stone shall bond 6 inches or more with stones beneath.

ARCHES.

Size. Arches formed of third-class masonry shall have ring-stones and sheeting-stones not less than 6 inches thick at intrados, in regular or irregular broken courses, as may best suit the stone.

Cutting. The ring-stones shall be dressed to lay within three-quarter inches of the centering and the sheeting-stones shall consist of selected stones of the depth of the arch with good bearings. No dog-holes in faces.

Joints. The joints shall be on radial lines for full depth shown on plans for the thickness of arch and shall not exceed three-quarters inch at intrados and one and one-half inches at extrados.

Bond. The ring-stones and sheeting-stones must break joints not less than six inches.

Backing. The extrados shall be roughly dressed and filled with mortar in which the stones shall be forced until spaces are completely filled.

Pointing. After completion of the whole work, the face-joints shall be cleaned out to a depth of not less than one (1) inch by use of a scraper and brush with water and then thoroughly pointed with mortar herein specified for "pointing mortar." This mortar shall be forced into the joints with a trowel until the mortar fills the space and reacts after the trowel passes. The joints shall then be rubbed smooth and cut straight.

CONCRETE.

Application. Concrete, of the class specified, will be used in such places and with such forms and such dimensions as may be shown on the plans or may be ordered by the Engineer.

Embedded Steel or Iron. When the conditions make it desirable to reinforce concrete by the use of embedded steel or iron, the details will be shown on the plans.

CLASS.

Concrete will be classified as follows:

First-class Concrete. Made of one part of American Portland cement, two and one-half parts of clean sand and five parts of crushed stone or gravel.

Voids. Before beginning construction, the Engineer shall determine the voids in the crushed stone or the gravel which is to form the aggregate of the concrete. The voids shall be determined by filling a 12-inch cubical box with dry crushed stone or gravel, placing this on accurate scales and weighing the water required to cover the contents.

Proportion. The proportion of mortar which is to form the matrix of the concrete shall then be varied slightly if necessary in order that it shall exceed the natural voids by not more than 1 to 2 per cent. of the total mass of the loose aggregate. This proportion shall be used until a change in the character of the aggregate may require a slight variation in the proportion of mortar.

Crushed Stone. Crushed stone for concrete shall be of approved kind and quality of rock which must be known, before crushing, to be free from soil or mud or dirt. The crusher shall be set to produce fragments whose maximum dimension shall be 2½ inches and shall include the smaller product of the crusher except the dust which shall be removed by a screen.

Crusher Dust. In special cases where the State Engineer may consider it to be of advantage to the work to use the total product of the crusher, the actual amount of crusher dust per cubic yard of crushed stone shall be determined and this shall be considered as a substitute for an equal bulk of sand.

Gravel. Gravel for concrete shall be of approved kind and quality, screened to remove fragments larger than 2½ inches, and washed, if required, to clean it.

Cement. Cement for concrete or for mortar shall not be used directly from any original package, but the contents of five packages shall first be mixed dry in order to obtain uniformity.

Machine Mixing. Machine mixing will be required in all cases where the quantity of concrete to be made at one locality exceeds 200 cubic yards. The machines used shall be of an improved kind for which the proportions for each batch are exactly measured; consideration will not be given to any continuous mixer in which the proportions or the mixing depend upon the shovelers.

The product must be so thoroughly mixed that every face of every particle of stone or gravel is completely coated with mortar.

Frost. During cold weather, special care must be taken to mix mortar and concrete with the least water which will give complete combination.

Limit to Cold. No mortar shall be mixed nor concrete or masonry laid when temperature falls below ten degrees (10°) above zero Fahrenheit.

Brine. During freezing weather, mortar shall be mixed with brine, formed by dissolving salt to give about 1 per cent. of saturation for each degree of temperature below freezing point.

The brine shall be made in barrels and shall be stirred from the bottom before using to insure uniformity, as shown by frequent observation of salometer. An excess of salt is injurious, and a saturated solution which shows free salt lying in bottom of barrel, shall never be used.

Protection. When the mercury falls below ten degrees (10°) above zero Fahrenheit, newly laid masonry and concrete shall be covered with canvas and otherwise protected to retard freezing.

On work of importance, the Engineer or the Inspector may withhold permission to do work during freezing weather, until the sand and water are heated to 200 degrees Fahrenheit, by use of steam coils and otherwise and until provision is made for covering as above.

Hand Mixing. Mixing by hand may be permitted on pieces of work where the quantity of concrete to be made is less than 200 cubic yards, and shall then be done in the following manner:

Aggregates. The stone or gravel shall be sprinkled while in the pile so that there shall be no dry dust. The measured quantity for each batch shall then be spread on a plank bed in a layer not more than 4 inches thick. The measured quantity of mortar shall then be made on a separate mortar bed in a manner described as follows:

Mixing. The dry mixed cement shall then be measured by bulk as wanted and the specified proportions of dry sand shall also be measured by bulk in the mortar box where the dry cement shall be uniformly

spread over it. The mixture shall then be made while dry, by turning with shovels, or the Engineer may require that the dry sand and cement shall be screened, as being the most effective and easiest way of securing a perfect mixture, of uniform color and without streaks, which will be required before adding water to make mortar, which shall be done gradually to avoid washing the cement away from the sand.

The quantity of mortar made at each batch shall be no greater than will be used in 45 minutes after beginning to mix with water. If mortar has set at all before using, it shall not be retempered but shall be thrown away.

This mortar shall then be spread over the layer of crushed stone or gravel and the mass shall then be thoroughly mixed by turning three or more times with shovels and by using hoes at the same time to help the shovels to mix the batch. This shall be done as rapidly as possible until every face of every particle of stone or gravel is completely coated with mortar.

Depositing. Concrete shall be deposited in layers not exceeding 9 inches in thickness before ramming. In joining new concrete to old work or to concrete that has already set, precaution shall be taken to secure a perfect bonding by cleaning and washing the work already in place, and by spreading over its surface a thin layer of mortar before the new concrete is placed. In order to bond the successive layers, timbers 6 inches square shall be bedded in the top of the layer when it is formed and these shall be removed before the next course is deposited, leaving grooves in which to form a bond.

No concrete shall be slid down a chute or thrown to the place where it is to be laid, but it shall be carried and deposited without dropping or rolling. Any fragments of stone which may separate themselves from the mass are to be collected and mixed with the next batch.

Separate Batches. In any given layer the separate batches shall follow each other so closely that each one shall be placed and rammed before the preceding one has set so that there shall be no line of separation between the batches. When a machine mixer is used, the successive layers must also follow each other before the preceding layer has set so that each day's work shall form a monolith.

After the concrete shall set, it shall not be walked upon in less than 12 hours.

Ramming. The operation of ramming shall be so conducted as to form a compact, dense, impervious artificial stone, whose specific gravity is close to that of the natural rock which was crushed to form the aggregates. The ramming must be so thorough as to perfectly compact the concrete and to fill all voids so that the water comes to the surface and that the mass quakes slightly under the blows of the rammer and shows a smooth face when the forms are removed.

Porous Concrete. No plastering on the face will be allowed and any concrete which is porous, or which has been plastered, must be removed and replaced at the expense of the contractor.

Forms. The contractor shall construct suitable forms, the cost of which for material and labor shall be included in the price per cubic yard for

the concrete and the interior shape and dimensions of which shall be such that the finished concrete shall be of the form and dimensions shown on the plans or as ordered by the Engineer. All forms shall be set true to the lines designated and shall be so built as to remain firm and secure until the concrete is perfectly hardened. All forms must be satisfactory to the Engineer and shall remain in place so long as he deems necessary, but not less than 48 hours. The interior surfaces of the forms which come in contact with all exposed surfaces of the concrete shall be of dressed lumber having close joints or of rough lumber lined with heavy oiled paper, and shall be so constructed as to leave all exposed surfaces of the concrete with a smooth, even and presentable surface.

Exposed Faces. The exposed faces and copings of all concrete shall be formed of mortar of the same proportions and of the same kind and quality of cement and sand as that which forms the matrix of the concrete. The facing shall be not less than 1 inch nor more than 2 inches in thickness. The facings and backings shall be formed simultaneously in the same horizontal layer. In order to gauge the thickness of the facing correctly, a plate or grating of thin metal with convenient handles shall be set on edge parallel to, and 2 inches from, the front wall of the forms. The facing material of mortar of the same proportions as that which forms the matrix of the concrete shall be deposited in the space between this plate and the form; the concrete of the backing shall then be deposited against the back of this plate, which may then be withdrawn and the whole mass thoroughly rammed so as to bond the facing and backing and efface the line of demarkation between them. No piece of stone shall be forced nearer to the exposed surface than 1 inch.

Sections. The walls and parts of structures may be built in alternate sections of such dimensions as are shown on the plans or directed by the Engineer, but not exceeding 50 feet in any one dimension.

Keys between Sections. On the dividing line between adjoining sections shall be formed a key-wall or well, not less than 6 inches square, one-half being in each section and extending from top to bottom of the section. These key-ways shall afterwards be filled with puddled clay or other material properly rammed in place to stop percolation of water.

Sprinkling Exposed Surfaces. All finished and unfinished work until thoroughly set, shall be kept moist by sprinkling at short intervals.

Protection. In warm weather concrete must be covered with canvas, or otherwise protected from the sun and in cold weather it must be covered in such way as to retard freezing.

Surface Finish. The top surface of the coping must be formed immediately after the underlying course is completed and before this course takes its initial set. The top surface shall be formed of mortar of the same proportions and of the same kind and quality of cement and sand as that which forms the matrix of the concrete and shall be finished by cutting off excess with a straight edge, and then rubbed smooth and hard with a float by skilled sidewalk finishers or men equally efficient. The facing and coping shall show a smooth dense surface without pits, irregularities or blow-holes or bubbles, and this is most likely to be secured by thorough and systematic ramming and rubbing. The edges of coping, the joints of sec-

tions and other exposed angles of structures, must be beveled or rounded to a regular curve if so shown on the plans or ordered by the engineer.

Concrete under Water. Concrete shall never be laid in running water and shall not be laid in still water nor exposed to the action of water before setting, except with special permission of the Engineer and then in such manner as may be specially directed.

STONE PAVING.

Stone paving shall be laid for culvert entrances and bottoms and outlets and at such other places where it may be shown on plans or where it may be ordered in writing by the Engineer, within the limit of amount shown on quantity sheet or on plans.

The paving shall be formed of sound, durable, flat, quarry stone laid on edge and lengthwise of the flow, or may be of sound, hard cobble-stones if so shown on plans.

Foundation for paving shall be formed of sand or gravel of the depth shown on plans, which shall be not less than 4 inches. The paving shall be formed of stone not less than 6 inches deep or as shown on the plans and not less than 4 inches wide and 12 inches long, laid to break joints at least 4 inches. Each stone must be full depth of the paving as shown on plans and the joints shall be filled with sand, or with Portland cement mortar as specified in the quantity sheet.

The paving shall be thoroughly rammed so as to bring each stone to a firm bearing on the gravel or sand and all to a uniform surface before filling the joints.

COBBLE GUTTERS.

Cobble gutters will consist of round "hardheads" of a quality approved by the Engineer, not less than 4 inches in diameter, laid with close joints to grade and line, upon a foundation of 6 inches in depth of sand, the whole to be thoroughly rammed in place. Old paving stones which have become cobbled may be used. Cobbles shall be laid in a thin bed of Portland cement mortar on steep "grades" or when so shown on the plans.

FLAGGING.

All flagging shall be of sound, strong, durable stone, of a quality satisfactory to the Engineer and of such sizes and thickness as shown on plans and as may be required to span the different culverts, and shall have a firm bearing of at least 9 inches back from the face of the supporting walls and shall be laid with close joints. Slabs of concrete with embedded metal may be used if so shown on the plans.

BRIDGES.

Abutments shall be built of masonry as shown on plans. Bridges shall be as shown on the plans.

EXISTING CYCLE PATHS AND FOOT PATHS, AND SHADE TREES.

Wherever a cycle path or foot-path shall have been constructed along the road which is to be improved, said path shall be recognized by the contractor as an existing and important work which shall not be covered, injured or obstructed unless the location is such that such path cannot be wholly avoided. Special care shall be used to avoid injury to trees along the roadside.

ROAD INTERSECTIONS AND PRIVATE DRIVEWAYS.

These shall be graded as shown on plans, or in a manner which gives free access to the road and is satisfactory to the Engineer.

CROSSINGS FOR DRIVEWAYS.

Crossings of ditch at roadside shall be made by plank bridges formed of spruce or hemlock lumber, or as shown on plans or on quantity sheet.

CULVERTS BENEATH DRIVEWAYS AND CROSSINGS.

Where the side ditches must be carried beneath driveways and road crossings, culverts shall be built of the size, length and materials shown on the plans and shall consist of cast iron pipe, or of vitrified pipe, or of concrete, or of planks, as may be shown on plans or quantity sheet, and as specified for "underdrains and culverts."

When vitrified or cast-iron pipes are used, they shall be laid on timber foundations if found necessary. Where the top of any vitrified drain pipe comes within 12 inches of the subgrade, the pipe shall be "Double Strength Culvert Pipe," second quality free from defects impairing their strength. The method of laying to be as specified for "underdrains and culverts."

The back-filling around the pipes shall be thoroughly tamped under, around and over the pipes and the driveways and road-crossings left in good condition.

Concrete Culverts shall be formed of first-class Portland cement concrete made as specified under head of "concrete" and as shown on the plans.

Plank Culverts, or driveways, shall be formed of spruce or hemlock plank and timber of approved quality and as shown in the plans.

STEEL FOR BRIDGES.

Steel, except as otherwise provided by these specifications, shall be made by the acid or basic open-hearth process and shall be uniform in character; finished material shall be clean, smooth, straight, true to shape, of workmanlike finish and free from defects.

All structural shapes shall be of medium steel. All rivets shall be of soft steel.

Medium Steel. Test pieces cut from finished material shall show an ultimate strength of not less than sixty thousand (60,000) pounds per square inch and not more than sixty-eight thousand (68,000) pounds per square inch, an elastic limit of not less than thirty-five thousand (35,000)

pounds per square inch, an elongation of not less than twenty-two (22) per cent. in eight (8) inches, and a reduction of area at the fracture of not less than forty (40) per cent. Medium steel shall not contain more than five one-hundredths (5-100) of 1 per cent. of sulphur.

Acid steel shall not contain more than six one-hundredths (6-100) of 1 per cent. and basic steel shall not contain more than four one-hundredths (4-100) of 1 per cent. of phosphorous. It shall endure bending at eighty degrees (80°) Fahrenheit, one hundred and eighty degrees around a circle whose diameter is equal to the thickness of the test piece without signs of cracking.

Soft Steel. Test pieces cut from finished material shall show an ultimate strength of not less than fifty thousand (50,000) pounds per square inch and not more than fifty-eight thousand (58,000) pounds per square inch, an elastic limit of not less than thirty thousand (30,000) pounds per square inch, an elongation of not less than twenty-eight (28) per cent. in eight (8) inches and a reduction in area at the fracture of fifty (50) per cent.

Soft steel shall not contain more than four one-hundredths (4-100) of 1 per cent. of sulphur. Acid steel shall contain not more than five one-hundredths (5-100) of 1 per cent. and basic steel shall contain not more than three one-hundredths (3-100) of 1 per cent. of phosphorous. It shall endure bending as specified above for medium steel flat upon itself without signs of cracking.

IRON CASTINGS.

Iron castings shall be made of the best quality of gray iron and shall be free from defects.

WORKMANSHIP.

All workmanship shall be first-class in every particular.

INSPECTION.

All material and workmanship shall be subject at all times to inspection and acceptance or rejection by the State Engineer and Surveyor. All structural material and workmanship shall comply with the bridge specifications of the State Engineer and Surveyor for the year 1900.

TIMBER AND PLANKING.

Timber and planking shall be used as shown on the plans and as directed by the Engineer. Bridge plank shall be of uniform width for any one structure and shall be not less than 10 inches nor more than 12 inches wide. All timber and plank shall be of a kind shown on the plans, sound and free from sap, shakes, bad knots or decay, and acceptable to the Engineer.

FENCING.

Fences shall be constructed on lines given by the Engineer, in accordance with the plans and these specifications.

Posts shall be of oak, cedar, chestnut, or other wood acceptable to the Engineer, and 6 inches square, or five inches in diameter at the smaller

end, if round, after the bark is removed; and 6½ feet long. They will be notched for guard-rails, and sloped on top, as shown on plans. Posts will be set 3 feet into the ground and the earth firmly tamped around them in a manner satisfactory to the Engineer. They will be placed eight feet apart center to center.

Guard Rails shall be of spruce, hemlock or other wood, acceptable to the Engineer, and of the form and secured to the posts as shown on the plans, in a workmanlike manner, satisfactory to the Engineer.

RAILING.

The railings for all bridges shall consist of 1½-inch or 2-inch steel or wrought-iron pipe, as shown on plans, with railing posts, and fittings, and with cast iron foot pieces securely fastened to planking with lag bolts. All parts must be thoroughly painted after putting in place with two (2) coats of approved paint of some well known brand, delivered upon the work in unbroken cans. The first coat shall be dark and the second coat shall be light in color, so as to enable the inspector to see that each coat fully covers all parts.

CLEANING OLD CULVERTS.

Old culverts must be thoroughly cleaned to the satisfaction of the Engineer.

SEEDING SLOPES AND SHOULDERS.

At the time and in the manner directed by the Engineer, the contractor shall seed the shoulders and slopes of embankments with a lawn grass seed, of a kind and quality satisfactory to the Engineer, using not less than one bushel to the acre.

CLAUSES OF GENERAL APPLICATION.

1. The plans and specifications are a part of the contract and will be held to cover any and all work that could be reasonably inferred as needed taking the two together for a complete and workmanlike job. Work shown on the plans and not mentioned in the specifications or vice versa will be done the same as if shown by both, when and where required.

2. All work will be neatly cleaned up on completion, according to the Engineer's directions, and be left in a neat and orderly condition ready for use.

3. The contractor hereby assumes all risks and liabilities for accidents or damages that may accrue to persons or property during the prosecution of the work, by reason of the negligence or carelessness of himself, his agents or employees.

4. The successful bidder shall satisfy the State Engineer, before the contract is awarded to him, that he has, or will promptly provide suitable and proper men, and all tools and machinery for each of the different kinds of work.

5. Should any work be required, that in the judgment of the State Engineer is not included under these specifications, or not covered by the prices named in the contract, such work shall be done pursuant to the

State Engineer's written direction, after the price therefor shall have been agreed upon, and no extra work will be paid for unless so ordered.

6. The right is reserved to make such changes in the plans or specifications as may, from time to time, appear necessary or desirable, and such changes shall in no wise invalidate this contract. Should such changes be productive of increased cost to the contractor, a fair and equitable sum therefor, to be agreed upon before such changed work shall have been begun, shall be added to the contract price, and in like manner deductions shall be made. Should such changes make no increase in the total quantities of work, the changes shall be made without increased payment.

7. The contractor shall, without extra compensation, grade a safe, proper and workmanlike connection with all intersecting public or private roads or driveways, according to the Engineer's directions.

8. The work shall progress in such manner and at such time as the Engineer may direct.

9. All material which may be rejected shall at once be removed from the vicinity and replaced by material of approved quality.

10. The contractor shall give his constant personal attention to the work while it is in progress, or he shall place it in charge of a competent and steady foreman who shall have authority to act for the contractor, and who shall be acceptable to the Engineer. The contractor shall at all times employ a sufficient number of workmen for the proper performance of the several works which he shall prosecute to full completion in the manner and time specified. Any workman whom the Engineer may deem incompetent or unfit for duty shall be at once discharged.

The work under this contract shall be performed by the contractor and by workmen under his immediate superintendence, and not by a subcontract or a sub-contractor, except with previous written consent of the State Engineer.

11. Should the contractor at any time fail or refuse to comply with the these specifications, the State Engineer, ten days after giving written notice to the contractor, may purchase necessary materials and employ proper workmen and perform the work; the cost of such materials and labor being deducted from the contract price, as the State Engineer may decide.

12. Wherever the word "Engineer" is used in these specifications, it is understood to mean the State Engineer and Surveyor or his representatives in charge of the work.

COMMENCEMENT OF WORK.

Work must be started within ten days after the signing of the contract.

COMPLETION OF WORK.

All road improvements to be completed by October 15, 190.. If for any cause the entire contract cannot be completed by October 15th, the work shall be arranged so that it may be closed by that date, bringing the top course up within 25 feet of the end of the lower course and then left to be completed the following season.

SPECIAL.

The contractor shall conform to the provisions of Chapter 115 of the Laws of 1898, Chapter 415 of the Laws of 1897, 444 of the Laws of 1897 and 567 of the Laws of 1899, relative to the Labor Law and to the assignment and subletting of contracts.

INSTRUCTIONS TO BIDDERS.

1. Bids will be made upon the blank form which follows these specifications, which specifications with the original bid will be attached to and form a part of the contract.

2. Each bid shall be accompanied by a New York draft or a certified check, payable at sight to the order of the State Engineer and Surveyor for 5 per cent. of the amount of the proposal; which check shall be held until the execution of the contract.

The successful bidder who fails to enter into contract will forfeit his check.

When the contract has been made, the various checks will be returned to the bidders who deposited them.

3. The successful bidder must furnish a bond for the faithful performance of the work as provided by law; such bond to be for half the amount of the contract, and with sureties and in form satisfactory to and approved by the State Engineer.

4. Each signature to proposals, guarantees, contracts and bonds shall be written out in full, and each signature to guarantees, contracts and bonds shall be attested by a witness and shall have affixed an adhesive seal.

5. The place of residence of every bidder and post-office address, with county and state, must be given after the signature.

6. One copy of the advertisement as published must be securely attached to and will be considered as forming a part of each proposal.

7. All blank spaces in the proposal and bond must be filled; and the addition in writing of any condition, limitation or provision will be liable to render the proposal informal and to cause its rejection.

8. No bids will be received after the time set for opening them.

9. The State Engineer and Surveyor reserves the right to reject any or all bids, and to disregard the proposal of any failing contractor.

10. Bidders are invited to be present at the office of the State Engineer and Surveyor in Albany when the bids are opened.

ENGINEER'S ESTIMATE OF QUANTITIES.

Quantities.

..........Acres grubbing and clearing.

..........Cubic yards excavation of all kinds (including earth and rock), of which there may be used about..........cubic yards to form..........cubic years of embankment rolled in place.

..........Cubic yards embankment rolled in place, requiring............ cubic yards, of which..........cubic yards may be obtained in the excavation of all kinds, including earth and rock.

..........Cubic yards broken..................macadam rolled in place.

..........Cubic yards broken...........macadam top rolled in place.

..........Cubic yards extra broken................in piles for maintenance, loose measurement.

..........Cubic yards........................screenings in place, loose measurement.

..........Cubic yards........................screenings in place, loose measurement.

..........Cubic yards...........clean sand in place, loose measurement.

..........Cubic yards extra......................screenings in piles for maintenance, loose measurement.

..........Cubic yards first-class Portland cement concrete.

Quantities.

..........Cubic yards third-class masonry in Portland cement mortar.
..........Square yards paving..................................joints.
..........Square yards Telford base.
..........Square yards cobble gutter.
..........Square feet......inch stone flagging in place.
..........Linear feet......inch cast iron pipe (for side drains laid in place complete).
..........Linear feet......inch cast iron pipe (for culverts laid in place complete).
..........Linear feet......inch cast iron pipe (for culverts laid in place complete).
..........Linear feet......inch cast iron pipe (for culverts laid in place complete).
..........Linear feet 12-inch cast iron pipe (for culverts laid in place complete).
..........Linear feet 16-inch cast iron pipe (for culverts laid in place complete).
..........Linear feet 18-inch cast iron pipe (for culverts laid in place complete).
..........Linear feet 5-inch vitrified pipe (for underdrains laid in place complete).
..........Linear feet......inch vitrified pipe (for culverts laid in place complete).
..........Linear feet......inch vitrified pipe (for culverts laid in place complete).
..........Linear feet 12-inch vitrified pipe (for culverts laid in place complete).
..........Linear feet 15-inch vitrified pipe (for culverts laid in place complete).
..........Linear feet 18-inch vitrified pipe (for culverts laid in place complete).
..........Linear feet......inch porous tile (for sub-drains laid in place complete).
..........Pounds steel beams, channels and structural shapes, and spikes and nails, in place complete.
..........Feet b. m. oak timber and plank in place complete.
..........Feet b. m. spruce or hemlock timber and plank in place complete.
..........Feet b. m. yellow pine timber and plank in place complete.
..........Rods fencing in place complete.
..........Linear feet 1½-inch gas pipe railing in place complete.
..........Linear feet 2-inch gas pipe railing in place complete.
..........Cleaning old culverts.
..........Acres seeding slopes and shoulders.
....
....

NOTE.—It is estimated that the following approximate quantities of crushed stone and screenings will be required to form the roadway, rolled in place as above stated; the surface of the macadamized roadway being equal to about..........square yards.

Broken stone, loose in bins, for base............cubic yards.
Broken stone, loose in bin, for top............cubic yards.
..................Screenings for filler for........course, loose in bin, ...cubic yards.
................Screenings for filler for............course, loose in bin, ...cubic yards.

It is, however, distinctly understood that the contractor must satisfy himself regarding the conditions governing all the work to be done, as to the nature and extent of all the materials required to make the work conform, in all respects, to the plans and specifications, it being further distinctly understood that the State Engineer does not guarantee the correctness of the quantities above stated, although care has been taken in preparing same, and that whether these quantities are increased or diminished no sum will be paid therefor in excess of the lump sum named in the contract, unless the plans or specifications shall have been changed as provided for in the "General Clauses" of this specification.

PROPOSAL.

ROAD NO. ....

STATE OF NEW YORK.—HIGHWAY IMPROVEMENT.

Chapter 115, Laws of 1898.

To the State Engineer and Surveyor of the State of New York:

The undersigned, resident.. of the .... of ...., hereby propose.. to improve, in accordance with the plans, and with the specifications hereto attached ...... miles of the public highway known as the .... road No. ...., for the sum of .... dollars ($............), said sum to be in full compensation for all services, labor materials and appliances required to complete said work according to the meaning and intent of said plans and specifications. In case extra work shall be required by the State Engineer, it will be done for the unit prices here given for the item named.

Excavation, per cubic yard........	1st class Portland cement concrete, per cubic yard.................
Telford base of local stone, per square yard....................	Fencing, per rod..................
Paving, per square yard...........	Spruce or hemlock, in place, complete, per 1,000 ft. b. m..........
3d class masonry, per cubic yard...	
....	....

On acceptance of this proposal for said work, do hereby bind.......... to enter into written contract, when required, with the said State Engineer and Surveyor, and to give the required bond and surety to perform said work for the consideration above named.

Dated .... 190..

....
Legal name of person, firm or corporation.

by ....
Signature of party authorized to sign.

The P. O. address of the bidder is
.... street,
.... city and State.

REPORT OF CEMENT TESTS.

STATE HALL, ALBANY, N. Y., *October* 1, 1901.

Hon. EDWARD A. BOND, *State Engineer and Surveyor:*

Sir:—I have the honor to submit the following report of the work of the cement testing laboratory of your Department for the fiscal year ending September 30, 1901.

This work has been principally routine work although some special tests have also been made. The requirements are given on page 36 of this volume.

There have been submitted to this Department during this past year 215 lots, consisting of a total of 2,647 samples. These have been given a total of 5,488 tests for tensile strength. With the exception of 110 tests, which were made of neat cement, the briquettes were made up in the proper proportions of cement and standard crushed quartz sand, according as the cements were Portland or natural cements. The number of tests made show an increase of 73 per cent. over the work of last year. This increase is due largely to the increased use of concrete upon State works.

The work done includes a large number of tests made for the State Architect and for municipal work. For the State Architect 57 lots of a total of 541 samples have been given 1,090 tests for tensile strength. As compared with last year, these figures show an increase of 26 per cent.

Each lot of samples submitted were, in addition to the tests for tensile strength, given tests for fineness of grinding and for initial and hard set.

The number of hot water tests made is much larger than the number made in previous years and the practice now is to make the test for each lot of samples received.

Of the samples submitted, 12 lots with a total of 156 samples. were rejected because they took their initial set too quickly; 3 lots with a total of 16 samples were rejected for showing very irregular and low tensile strength; 1 lot of 10 samples which

failed to pass the seven-day test satisfactorily passed the twenty-eight-day requirements and was then accepted; 1 sample representing 9 barrels was rejected for very low tensile strength, and 1 lot with 15 samples was rejected for failure to stand the hot water test.

The number of brands represented by the samples received remains about the same as last year although several brands new to this laboratory were among those received. The brands tested were: 19 American Portland, 13 American natural, and 1 American Puzzolan (or slag) cements.

The special tests inaugurated a year ago for the results of freezing cement mortar and of the use of a salt solution in such mortar were completed this year, and one new set of tests made and treated in a similar manner was started. These tests were started in March, 1900, and advantage was taken of all the freezing weather which then occurred. The Portland cements used were from samples taken from cement delivered for use on work then in progress, and the sand was natural sand taken likewise from the sand delivered upon that same work. The natural cement was taken from five barrels at a warehouse in Albany, and the sand was taken from a lot which was from the Patroon's sand bank, Albany, N. Y. The method of treating the briquettes was, as far as possible, the same as would have been given the mortar in the natural course of construction. As soon as the briquettes were made up one-half were put outside and allowed to freeze, and the other half were kept inside and under a damp cloth. Results were thus obtained giving the effect on mortar mixed with the salt solution and not frozen, as well as that which was frozen. Care was taken that those briquettes which were placed outside were kept from the sun's rays, just as the mortar would be kept during construction by the continual addition of work over it. During the period of exposure a record of the temperature was kept, and thus it became possible to note how many times the mortar became frozen and thawed. At about the same time as the water was let into the canal all these briquettes were put in water and

were kept there for the remaining time of the test. The results of the first series of tests were completed in March, 1901. The results of the set of tests started in February, 1901, are not complete but are published with the rest as far as obtained. The accompanying tables best show these results. It should be stated, however, that the very high results shown in some of the twenty-eight-day results were due to the briquettes being broken while frozen. Each of the results given is the average of five briquettes.

In February, 1901, some concrete blocks were made and put outside to freeze. These blocks were 6-inch cubes and were made up of concrete mixed in the proportion of 1 part Portland cement, 2½ parts natural sand, and 5 parts broken stone. The following were the percentages of salt solution used in mixing up each set of blocks: None, 10, 20, 30, 40, 50 and 60. Two blocks were made in each set and as soon as moulded were put outside in the freezing weather. One other set was also made. This latter was made up of heated water and sand and was mixed up and put in the moulds out in a temperature of 18° F. The water was at 175° F. and the sands at 200° F. when used. All of these blocks have been left outdoors and exposed to the prevailing weathers. No signs of disintegration are apparent in any of them as yet, the corners and edges remaining sharp and hard.

A brief description of the method used in making the tests in this laboratory will probably make the results of the tests much better understood as well as more easily comparable with the results obtained in other testing laboratories. The method is as follows:

Sampling. After the cement, proposed to be used upon any contract work of the State, has been delivered and well stored, the engineer in charge, or his representative, takes one sample from every tenth barrel of cement or from the equivalent of the tenth barrel when packed in sacks. Each sample fills a three-inch cubical tin box; and each is properly marked with its number, the brand of the cement, the work upon which it is to be used, and the date of sampling. The tin boxes are then packed in wooden cases made expressly for the purpose and each capable of holding ten tin boxes. These cases are then sent by express to this laboratory.

Upon receipt here a portion of every sample is taken and these portions are thoroughly mixed into a large general sample. From this mixed sample is taken the cement used in making the tests for fineness, setting qualities, and soundness.

Fineness. The tests for fineness consist of weighing on a scale capable of weighing to one ten-thousandth part of a pound a certain amount of the cement. This is carefully sieved through standard sieves of 2,500 and 10,000 meshes to the square inch. The residue is weighed and the percentages thus obtained. Ninety-five per cent. of the cement must pass the 2,500 mesh sieve and 90 per cent. must pass the 10,000 mesh sieve.

Neat pats. From the mixed sample enough is also taken to make three pats. This is mixed up into a stiff paste by adding from 20 to 25 per cent. by weight of water to Portland cements and from 30 to 33 per cent. to natural cements. After being thoroughly trowelled this paste is moulded into three pats on glass plates about three inches by four inches in size. These pats are about one-half inch thick in the center and are drawn out to thin edges.

Setting qualities. As soon as made, the neat pats are placed in a moist-air cabinet and allowed to take their set. One pat is examined from time to time, and when it will hold the one-twelfth-inch wire loaded to one-quarter pound and the one-twenty-fourth-inch wire loaded to one pound without an appreciable indentation the initial and hard sets are respectively noted. To be accepted, Portland cements must not take an initial set in less than 25 minutes, or natural cements in less than 15 minutes. The time is estimated from the moment of adding the water to the cement.

Soundness. When the pats are fully hardened, one is kept in the steam of water at 125 degrees Fahr. for an hour and is then put into the hot water. This is the "hot water test"; and if the pat, after remaining for 24 hours in water maintained at 125 degrees Fahr., shows no sign of blowing or cracking, it is reported as "Good." The other pats are given normal air and water tests by being kept respectively in air and water maintained at from 60 to 70 degrees Fahr.

Tensile strength. Mortar. For the tests for tensile strength, each sample is gauged separately with its proper proportion of standard crushed quartz sand—1 part of Portland cement to 3 parts of sand, or equal parts of natural cement and sand, parts by weight. As each sample is thus gauged it is put into a small pan and each is kept in the order of its number so that the samples will not lose their identity. Each separate sample of cement and sand is thoroughly mixed dry and then from 10 to 12½ per cent. by weight of water is added to Portland cements and from 16 to 17½ per cent. by weight to natural cements. The percentage used is such as will give a stiff mortar which will show up water when the trowel is drawn heavily over it. This mortar is thoroughly trowelled and is then put into the moulds.

Briquettes. The mould, which is of brass and of the standard form adopted by the American Society Civil Engineers, is first filled with loose mortar and this is carefully compacted by pressing down with the thumbs protected by rubber gloves. More loose mortar is placed in the mould and is pressed down as before. This makes about three-quarters inch

of mortar in the mould, having been placed in about three-eighths-inch layers. The top layer is placed by striking a further addition of loose mortar with the back of the trowel. The briquette is then struck-off even with the top of the mould. Two briquettes are made from each sample.

Treatment. As soon as made, the briquettes are placed upon plates of glass and are placed in the moist-air cabinet, care being taken to keep them in their order so as to still retain their identity. After the mortar has hardened, the briquettes are removed from the moulds and replaced in the cabinet. Twenty-four hours after gauging, they are marked with a number which is given to each briquette consecutively as each is made and are immersed and kept in water maintained at a temperature of about 60 to 70 degrees Fahr.

Breaking. On the seventh day after gauging, the first test for tensile strength is given, and 21 days later, or on the twenty-eighth day after gauging, the second briquette of each sample is broken for tensile strength. A new Fairbanks cement testing machine with all the latest improvements is used to obtain these results.

All the operations are conducted by myself alone, so that there is perfect uniformity in the treatment of all the samples.

Strength. Portland cements, mixed as described, must show an average of at least 125 pounds per square inch in tensile strength in 7 days and an average of at least 220 pounds per square inch in 28 days. Natural cements, mixed as described, must show a tensile strength of an average of at least 65 pounds per square inch in 7 days and an average of at least 150 pounds per square inch in 28 days.

Neat briquettes. Tests for tensile strength of neat briquettes are seldom made, as the practice of this department is to place the greater dependence upon the mortar tests. Whenever they are made, however, they are made and treated in a manner similar to that given mortar briquettes; excepting, of course, that a greater percentage of water is used—usually being about one per cent. less than that used in gauging for the neat pats of that particular lot or brand. Neat briquettes of Portland cement, so made, must show an average of at least 400 pounds per square inch in tensile strength. Neat briquettes of natural cement, made as are mortar briquettes, and kept in moist air 2 hours and then immersed in water for 22 hours must show an average of at least 60 pounds per square inch in tensile strength.

All results obtained at the end of the 7-day tests are submitted to Mr. William Pierson Judson, Deputy State Engineer, and the lots are accepted or rejected by him according as the results show that the cement passes or fails in the tests.

Very respectfully,

R. S. GREENMAN,

In charge of cement tests.

[illegible] Tests for Results of Freezing Cement Mortar.

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Kind of [illegible] sand.	Condition of sand.	Proportion of sand to cement (parts by weight).	Water used. Per cent of weight of dry sand and cement.	Length of test.	Tensile Strength in Pounds per Square Inch. Kept inside under damp cloth. Fresh water used.	Kept inside under damp cloth. Saturation of brine used. 20 per cent.	40 per cent.	60 per cent.	Kept outside and frozen and thawed. Fresh water used.	Kept outside and frozen and thawed. Saturation of brine used. 20 per cent.	40 per cent.	60 per cent.	Number of times frozen and thawed.
[illegible]	[illegible]	[illegible]	[illegible]	14[illegible]	Wilburs Basin, N. Y.	Natural	3:1	12½	7 days.	245	312	349	185	102	217	184	178	3
									28 days.	262	311	250	273	248	341	310	303	10
									3 mos.	368	389	383	316	322	354	320	305	16
									6 mos..	424	390	400	378	391	392	381	343	16
									9 mos ..	403	394	405	421	429	435	467	367	16
									1 year	463	390	446	469	437	459	442	432	16
Alpha Portland	[illegible]	[illegible]	[illegible]	115	Sandy Hill, N. Y....	Natural	3:1	12½	7 days.	203	171	216	152	45	164	157	135	2
									28 days.	206	188	215	178	204	421	401	448	11
									3 mos..	252	258	306	245	253	259	285	276	14
									6 mos..	234	247	296	264	259	252	313	291	14
									9 mos .	220	263	331	256	273	265	338	309	14
									1 year.	278	280	302	262	288	278	332	328	14
Atlas Portland	[illegible]	[illegible]	115	250	Albion, N. Y........	Natural	3:1	12½	7 days.	313	320	294	276	187	116	204	180	*
									28 days.	489	558	432	441	136	279	305	280	9
									3 mos..	666	591	528	518	437	495	423	475	28
									6 mos..	673	594	593	529	432	437	484	475	28
									9 mos..	759	697	660	673	458	484	488	570	28
[illegible] Newton's Rosendale.......	[illegible]	91	42	66	Patroon's, Albany, N. Y...............	Wash'd	1:1	17½	7 days.	75	120	153	165	103	93	82	81	4
									28 days.	204	216	264	186	181	147	157	159	18
									3 mos..	288	317	291	226	259	239	266	232	18
									6 mos..	349	335	283	306	336	393	350	321	18
									9 mos..	328	308	338	331	342	308	376	326	13
									1 year..	374	337	324	316	320	332	303	309	13

F. O. Norton's Rosendale	96½	91	42	66	Patroon's, Albany, N. Y.	Wash'd	2:1	15	7 days.	43	109	103	83	63	73	61	36	3
									28 days.	114	184	210	156	86	121	128	122	12
									3 mos..	267	272	272	231	243	281	205	210	12
									6 mos..	343	345	309	237	373	353	387	385	12
									9 mos..	345	318	307	267	365	414	372	389	12
									1 year..	418	341	312	260	395	415	394	359	12
F. O. Norton's Rosendale.	96½	91	42	66	Patroon's, Albany, N. Y.	Wash'd	3:1	12½	7 days.	27	76	69	87	48	24	25	20	3
									28 days.	58	140	110	129	76	45	45	46	12
									3 mos..	207	201	199	211	197	76	193	193	12
									6 mos..	221	236	200	194	326	116	287	297	12
									9 mos..	254	249	220	184	287	153	298	303	12
									1 year..	267	256	239	220	342	129	......	320	12

* Briquettes were frozen but not thawed before being broken as weather remained below freezing.

Report of Charles Wyeth, Surveyor of Oyster Lands Under the State Engineer and Surveyor of New York.

October 1, 1901.

To Edward A. Bond, *State Engineer and Surveyor of the State of New York:*

Sir—I have the honor to present the following report of my work, surveying and mapping lands under water of the State of New York for shellfish culture, and preparing the necessary papers connected therewith for the fiscal year ending October 1, 1901.

My work of the past year under your Department and the direction of Superintendent of Shellfisheries, Hon. B. F. Wood, has been in continuation and pursuance of the oyster surveys initiated by the Hon. Eugene Blackford in 1887, and carried forward by each successive shellfish commissioner to the present time.

During the past year we have received 137 applications for oyster grounds, of which 136 were for leases and the remaining one for a franchise of 29 acres. The total acreage covered by these applications is 2,467 or nearly four square miles. These grounds are in addition to those heretofore cultivated under lease from the State and are located in Long Island Sound, Jamaica Bay, Raritan Bay, Hempstead Harbor and Manhasset Bay.

Upon to October 1, 1900, there were 4,671 acres under lease and 19,976 acres under franchise from the State. At the present date, December 1, 1901, there are under lease 6.055 acres, and under franchise, 20,005 acres—together held by about 2,000 applicants. Not included in this total are

1,054 acres applied for under 66 applications and lying, 8 in Hempstead Harbor and 58 in Manhasset Bay. The town of North Hempstead is contesting the right of the State to lease oyster ground in these waters. One piece has been leased in Hempstead Harbor after opinion by the Attorney-General favorable to the State. The disposition of this case by the Courts will apply to all the others. I have been unable to obtain sufficient data from Washington to survey the oyster grounds in Manhasset Bay and Hempstead Harbor, and although we have had 67 applications I have been informed that there are probably three times as many, all told, who are awaiting the decision of the Courts before applying in the above localities. Under these applications there will be added to our present coast line approximately 25 miles, along which it will be necessary to have signals built and located. I have calculated that we should have an appropriation of at least $2,000 in addition to the regular amount appropriated for this purpose if we are to undertake this work next summer. The Commission have also granted applications for oyster ground in the East river near College Point, where it will be necessary to locate new signals to enable me to locate the grounds. This work will also require the use of a steamer to cross backward and forward in making triangulations. I have been informed from many sources that notwithstanding the large yearly increase of oysters produced that the demand keeps pace with the production. This is borne out by applications received for new grounds which were greater in the last fiscal year than in that preceding and this has been the case for several years past.

Respectfully submitted by

CHARLES WYETH,

Surveyor of Oyster Lands.

Report of Land Bureau of the State Engineer Department.

ALBANY, N. Y., *October* 1, 1901.

Hon. EDWARD A. BOND, *State Engineer and Surveyor:*

Sir—I have the honor to present herewith a report on the various matters pertaining to the Land Bureau of your office for the fiscal year ending September 30, 1901.

During the fiscal year the Commissioners of the Land Office have applications for grants of land under water which are referred to this Department for examination and report, as are also a large number of miscellaneous matters relating to State lands. These matters require careful inspection and naturally consume a great deal of time.

The maps and papers are examined to determine their correctness and proper form, both from an engineering standpoint and to insure their conformity to the rules and regulations of the Land Office.

In some cases it is also necessary to visit and inspect the locations of the proposed grants to decide as to the advisability of making the grants on the lines of the application, or if necessary to have them modified.

It is also at times deemed advisable to deny some of these applications on account of interference with navigation, with the rights of adjoining owners, or the rights of the public.

There have been received during the past year 55 applications for land under water, situated in the following counties: Queens, 16; Rensselaer, 14; Richmond, 9; Erie, 3; Onondaga, 2; Suffolk, 2; Greene, 2; Kings, 2; and one each in Albany, Clinton, Columbia, Ulster and Washington counties.

Seventeen of the applicationns were for the purposes of commerce and the remaining for restricted beneficial enjoyment. Four of the applications are now being considered; but one application during the past year has been contested or had remonstrances filed against it, and hearings have been necessary to determine the rights of the several interested parties and to report the outcome to the Commissioners of the Land Office.

The State Engineer and Surveyor has sold at public auction all of those unappropriated lands of the State which have been ordered to be sold by the Commissioners of the Land Office. Nearly all of the lands sold were acquired through the Comptroller's tax sales.

The records of the office show that there were held during the year 15 public auctions, at which 59 parcels of land were sold. The sum of $8,095.57 was realized therefrom. The lands sold were in 11 counties as follows: Kings, 19; Richmond, 19; Niagara, 8; Chautauqua, 3; Clinton, 2; Erie, 2; Rockland, 2; Cattaraugus, 1; Lewis, 1; Nassau, 1; Westchester, 1.

Maps are now being made in this Department for the use of the State Engineer and Surveyor and the Commissioners of the Land Office which will show the lands under water adjacent to the shores of Queens and Nassau counties which have been granted by the Commissioners, and these maps when completed will, no doubt, prove to be of as great value as the similar maps of lands in Kings and Richmond counties. The maps for Nassau county are practically completed, while those of Queens are well under way.

There has been the usual amount of correspondence and answering of inquiries from surveyors, lawyers and others on matters pertaining to the original maps and descriptions of the Colonial and early State surveys filed in this office. The answering of such inquiries often requires much time and study, as there are frequently more than one survey of the same land made at different times by various surveyors and none should be overlooked. These maps become more valuable as time

passes, and as a large part of them are very old and describe lines of tracts of land which have become in many instances the boundaries of towns and counties, the value of those records become of still greater value.

For better preserving these records they are now being rearranged, placed in bound volumes and carefully indexed for convenience of reference.

That it is the proper method for the care of these valuable papers, and that it affords greater facility of finding particular papers with the certainty that none have been overlooked, has already been fully demonstrated.

Respectfully,

M. PECKHAM, JR.,

Assistant Engineer in Charge of Land Bureau.

Report of the Bureau of Bridges of the New York State Engineer Department for the Fiscal Year Ending September 30, 1901.

ALBANY, *September* 30, 1901.

Hon. EDWARD A. BOND, *State Engineer and Surveyor:*

Dear Sir.—I have the honor as Chief Bridge Designer and Inspector of the Bureau of Bridges of the New York State Engineer Department to report as follows for the fiscal year ending September 30, 1901:

During the year the office force in this bureau has consisted of the Chief Bridge Designer and four assistants.

Superstructure plans with necessary specifications and estimates of cost have been prepared and submitted to the State Engineer and Surveyor for the following described bridges:

Plate girder span over the Glens Falls Feeder in the town of Queensbury.

Plate girder span over the Champlain canal at Fulton street, Waterford.

Rivetted truss swing span over the Champlain canal at Waterford.

Rivetted truss span over the Champlain canal at Ontario street, Cohoes.

Plate girder span over the Erie canal at Twenty-third street, Watervliet.

Plate girder span over the Erie canal, near the upper Mohawk acqueduct.

Rivetted truss foot bridge (revised design) over the Erie canal at Brainard street, Whitesboro.

One rivetted truss fixed span and one rivetted truss swing span over the Black river at Pratt's Landing.

Plate girder foot bridge over the Erie canal at Lyell avenue, Rochester.

Three rivetted truss deck spans over Cattaraugus creek, on the Cattaraugus Indian Reservation, near Versailles, N. Y.

Rivetted truss span over Dolloff Cut (a part of the Conewango creek improvement).

Plans and estimates have also been prepared and submitted for the following described work:

Widening the north sidewalk on the lift bridge over the Champlain canal at Park avenue, Mechanicville.

Safety gates for the lift bridge over the Erie canal at Petersboro street, Canastota.

New cylinders of increased size for the lift bridge over the Erie canal at River street, Fort Plain.

Repairs to the lift bridge over the Erie canal at Water street, Albany.

Repairs to the lift bridge over the Erie canal at North Ferry street, Albany.

Repairs to the lift bridge over the Erie canal at Nineteenth street, Watervliet.

Repairs to the lift bridge over the Erie canal at Church street, Schenectady.

Repairs to the lift bridge over the Erie canal at Schuyler street, Utica.

Repairs to the lift bridge over the Erie canal at Petersboro street, Canastota.

Repairs to the lift bridge over the Erie canal at State street, Syracuse.

Repairs to the lift bridge over the Erie canal at West street, Syracuse.

Repairs to the lift bridge over the Erie canal at Caledonia avenue, Rochester.

Automatic safety brake for use on the inclined railway on the State Reservation at Niagara Falls.

Superstructure plans for a swing span over Black Rock harbor at Ferry street, Buffalo, are nearly completed.

All designs follow closely the best engineering practice of to-day. Effort has been constantly made to keep all details as simple as possible, to reduce the necessity for future repairs, to make the efficiency of machinery for lift bridges as great as possible and to keep the cost as low as is consistent with giving to all parts the proper degree of strength.

During the year this bureau has inspected as frequently as necessary and whenever requested by the Division Engineers all bridge superstructures in course of construction, and, at the time of final acceptance, this bureau has been fully satisfied that the work has been done in substantial accordance with the plans and specifications.

The rolled steel shapes used for the bridge superstructures are rolled at several of the principal steel mills of the United States and are made up into trusses, floor beams, stringers, etc., at the shops of the various bridge companies. On account of the large expense attaching thereto it is impracticable for this bureau to have men in its employ located at mills and shops for the purpose of making, on what are comparatively small amounts of material, the necessary mill and shop inspection required by the specifications. Such inspection is therefore regularly made by a firm of inspecting engineers appointed by the State Engineer and Surveyor. These engineers are able to make the inspection at low cost because their representatives inspect in connection with the State work large quantities of materials for other parties. Reports of mill and shop inspection are regularly received and upon receipt are carefully examined in detail by this bureau.

Shop drawings of all structural steel and machinery are submitted by the contractors for approval. These drawings are carefully examined and before approval is given it is required that they comply with the contract drawings and specifications.

During the session of the Legislature many approximate estimates of cost were made for various bridges and steel structures provided for by those bills which were referred to the State Engineer and Surveyor.

Whenever the Superintendent of Public Works has asked for examination of an existing structure, the examination has been made as promptly as possible and report upon the same with recommendations as to necessary repairs has been made to the State Engineer and Surveyor.

In like manner, plans for strengthening existing bridges or for building new bridges over the canals, submitted to the Superintendent of Public Works by street railway companies in connection with petitions for permission to cross the canal, have been carefully examined and report made thereon to the State Engineer and Surveyor. In some cases the plans submitted lacked a proper degree of strength and the plans were required to be corrected before approval was given.

On April 6th the bridge over the Oswego Canal at James street, Syracuse, fell into the prism of the canal from which the water had been drawn. A loaded electric car, a one-horse truck and several pedestrians fell with the bridge. A careful examination of the wreck was made by this bureau. Physical and chemical tests of some of the wrought iron members of the bridge were made by the inspecting engineers regularly appointed by the State Engineer to make mill and shop inspection. These tests showed the material in the lower chord links to have been of inferior quality. The conclusion was reached that the failure of the bridge was probably caused by overloading and by weakness due to inferior metal and hidden defects which no inspection could reveal.

The James Street bridge was constructed in 1858 and is one of many old bridges over the canals the principal trusses of which are commonly known as Whipple cast iron arches. The arched top chords of these trusses consist of cast iron segments abutting end to end; the bottom chords consist of welded wrought iron links joined by large cast iron pin; the vertical and diagonal web members consist of wrought iron rods.

At the time of construction these bridges were superior to others and were of ample strength to carry the imposed loads. Many of them are now seriously weakened by rust and overload-

ing and the trusses are often in poor adjustment, with the result that the loads are improperly distributed among the members. A failure of any one of many truss members would invariably result in the collapse of the bridge. The existence of hidden defects in cast iron members and in the welds of wrought iron members is not infrequent and such defects can not be discovered before the truss fails.

Rolled steel bars and shapes are used at the present time in all properly constructed bridges for all important parts, replacing wrought iron almost entirely and cast iron altogether, the use of cast iron for truss members being forbidden. All existing bridges with cast iron chords should be used with extreme care and under proper restrictions. It is recommended that the more important of these bridges be replaced by modern structures at as early a date as practicable.

Immediately after the failure of the James Street bridge inspection was made by this bureau of all State bridges carrying electric cars over the canals except those recently built on modern lines. Several of these bridges were found to be in very dangerous condition. Reports on the condition of all bridges thus inspected were made to the State Engineer and Surveyor as previously stated.

At James street and Warren street, Syracuse, the bridges have been rebuilt, using riveted trusses purchased from the New York Central and Hudson River Railroad. These trusses are too light to carry modern heavy steam railroad traffic, but are in good physical condition and have ample strength to carry city highway traffic and electric cars. This bureau has made all necessary examinations of the physical condition and has made necessary calculations of the strength of these trusses and also of railroad trusses purchased by the Superintendent of Public Works for use in the reconstruction of bridges at Elk street, Buffalo; Broadway, Fulton; and over Eighteen Mile creek.

Four noteworthy accidents have happened to lift bridges over the canal during the year; several cables broke on the west

lift of the bridge at Genesee street, Utica; a cylinder cracked on the bridge at South Salina street, Syracuse; a cylinder burst on the bridge at Clinton street, Syracuse; several shafts and sheaves broke on the bridge at South avenue, Brighton. The cables of the Genesee street bridge were in bad condition and the accident could have been prevented by renewing the cables at the proper time. The breaking of the cylinders at Syracuse was not due to fault of design or maintenance but to hidden defects in the castings which inspection failed to detect. The failure of the shafts on the Brighton bridge happened because the shafts were too small and the fault lies with the plans which were prepared and approved before the present State Engineer and Surveyor held the office and before this Bureau was formed.

Whenever the officers of any town acting under section 145 of chapter 568 of the Revised Statutes have asked for an examination and approval of plans and specifications, such examination has been promptly made and approval given as soon as the necessary corrections were made therein.

Earnest effort has been made to do the work assigned to this bureau with promptness and thoroughness and at as low a cost as is consistent therewith.

Respectfully submitted,

WILLIAM R. DAVIS,

Chief Bridge Designer.

Report of Co-operation of United States Geological Survey with State Engineer and Surveyor of New York.

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
WASHINGTON, D. C., *December* 1, 1901.

HON. EDWARD A. BOND, *State Engineer and Surveyor, Albany, N. Y.:*

SIR:—I have the honor to make herewith a preliminary statement of the work done under a proposition approved May 27, 1901, whereby the terms of the agreement of March 25, 1899, were continued in force for the fiscal year closing June 30, 1902, and which was signed by you on behalf of the State of New York, May 24, 1901, and approved by me on behalf of the U. S. Geological Survey, May 27, 1901, the same governing the expenditures to be made under Chapter 645, Laws of 1901.

By the terms of this agreement you were to allot $19,500 and this bureau was to allot a like sum to topographic surveying in the State of New York. In July this sum was increased by an additional $3,000 offered by you, and met by a like sum from the appropriation of this bureau, thus making the total allotments for 1901-2 amount to $22,500 each. In addition, there remained at the beginning of the field season an unexpended balance of the State appropriation of 1900, amounting to $2,321, making thus a total of $24,821 of State funds available for this cooperative work. The allotment by this bureau under the terms of this agreement was a like sum of $22,500 to this work, and there remained in addition an unexpended balance of our 1900 allotment of $7,671, making a total allotment by this bureau for field work in 1901 of $30,171. Accordingly, there

[illegible] with the State of New [illegible] State and Federal [illegible]

[illegible] accurate [illegible] at an expenditure of [illegible] or at an average of $1.11 per square mile. This triangulation furnishes in addition to existing unmapped data of like character, control for future mapping of [illegible] square miles, which will be represented on 60 atlas sheets. The primary spirit leveling resulted in the running of [illegible] linear miles, in the course of which 56 permanent bench marks of bronze or aluminum were established, and the positions of many other points were accurately determined.

There has resulted from field operations of the past season, in addition to the above primary control, a complete and accurate map on a scale of 1:62,500, or approximately one mile to the inch, and with a contour interval of 20 feet, of 2,576 square miles, all within the borders of the State. The results of these surveys will be published on 14 separate atlas sheets, covering portions of 19 different counties. In addition, 6 other atlas sheets, covering 1,303 square miles, in portions of 9 different counties, were partially surveyed. For those portions for which the surveys were completed, the average rate of expenditure was approximately $9.40 per square mile.

The total cost of the above work, including topographic surveys, primary triangulation and precise leveling, and including [illegible] expenses for the platting and drafting of the [illegible] positions in the [illegible] was [illegible] The average cost [illegible] surveying including expenditures on all [illegible] inception of this [illegible]

As the total allotment to this work was $54,992, there will remain a balance of State and Federal money at the beginning of the next field season in the spring of 1902, after deducting estimated office expenses, of approximately $8,392, which will be devoted to the early inauguration of field work in the State. I respectfully suggest that this balance be devoted to the completion of the following partially mapped sheets, viz., Long Lake, St. Regis, Hobart, Richmondville, Boonville, Wayland, and such others as you may designate.

Very respectfully,

CHAS. D. WALCOTT.

Director.

TOPOGRAPHIC SURVEY OF THE STATE.

Chapter 645, of the Laws of 1901, authorized the State Engineer and Surveyor of New York to continue to cooperate with the Director of the United States Geological Survey in making a topographic survey and map of the State of New York, and appropriated for this work the sum of $25,000. In addition to this there remained available for field work in the early spring months of 1901, a balance of $2,321 from the appropriation of 1900.

In accordance with the provisions of this law, an agreement was entered into between Hon. Chas. D. Walcott, Director of the United States Geological Survey, and myself, whereby the terms of the agreement of March 25, 1899, were continued in force for the fiscal year closing June 30, 1902, and which was signed by me May 24, 1901, and agreed to by the Director of the United States Geological Survey, May 27, 1901.

Under the terms of this agreement, and of a supplemental arrangement made in July, $22,500 of State funds were to be used out of the appropriation of $25,000 by the State, and $500 were retained for office expenses in the disbursing and clerical work. The United States Geological Survey was unable to meet $2,000 of the above appropriation until additional federal funds should become available in the season of 1902. Hence

the total of State funds allotted to this work was $22,500 and a balance of $2,321, making a total of $24,821. The federal survey likewise allotted $22,500, which, together with the unexpended balance of $7,671 from their allotment of 1900, rendered $30,171 of their funds available for topographical surveys. There was, accordingly, available for cooperative topographic surveys within the State of New York during the season of 1901, the total sum of $54,992.

RÉSUMÉ OF RESULTS.

Primary trangulation was extended over an area of 2,000 square miles during the past field season, by the occupying of 30 stations, the positions of which have been suitably monumented and exactly determined. This area is distributed over the counties of Fulton, Hamilton, St. Lawrence and Franklin, and small portions of Warren and Saratoga. A meridian line was established at Johnstown.

Hereto I append descriptions and final computations of primary triangulation stations, and meridian marks, located in the prosecution of this work during the previous field season of 1900. Those determined during the present field season, 1901, will be published in my next annual report, after their positions have been computed in office.

A line of precise levels was run between bench marks of the Deep Waterways Commission, the Barge Canal and the United States engineers at Utica, and those of this survey near Sidney and Hancock. The results will greatly strengthen the precise level net in the State. Including the above and the primary levels run to control the topographic mapping, there were run a total of 1,187 miles of principal levels which are permanently marked by 74 metal tablets.

Topographic mapping was completed for 14 separate atlas sheets, covering portions of 19 different counties. In addition, 9 other atlas sheets, covering portions of 9 different counties, were partly mapped. In all, 2,576 square miles of the area of

the State were finally mapped during the season, and an equivalent of 1,303 square miles were partly surveyed. The results are given in tabular statement in another part of this report.

That a greater area was not mapped for the expenditure made, is due solely to the fact that an unusually large percentage of work was undertaken in the Adirondack and Catskill regions. Here, owing to inaccessibility and the exceedingly difficult character of the surface for surveying, the cost per square mile of such work is about three times what it is in the more level and more thickly settled portions of the State, and the result in finished work is proportionately smaller.

CONCLUSIONS AND RECOMMENDATIONS.

There have been surveyed and mapped to date 147 separate atlas sheets, depicting the topography of 28,105 square miles, or over 59 per cent. of the area of the State. There have been engraved and published 106 separate atlas sheets, representing the topography of 19,048 square miles. The preliminary work incident to future mapping is in excellent condition to permit the prosecution of topographic mapping in any portion of the unmapped area of the State in which such mapping may be desired.

The average cost of mapping this area has been to date $12.41 approximately per square mile, of which sum the State has expended $148,500 of a total outlay of $348,936. With the expenditure of $5.28 per square mile the outlay to the State ceases. The federal bureau, however, has additional expenses to meet in engraving the maps, in printing them and in the prosecution of the geologic and hydrographic surveys which follow the publication of the topographic maps. There remain unmapped about 21,085 square miles of the area of the State, which will be represented on 97 additional atlas sheets. Of this area, 13,500 square miles, included within 60 atlas sheets,

is now controlled by primary triangulation and precise leveling and ready for the final topographic mapping.

I strongly recommend the enactment of legislation similar to that of chapter 645, Laws of 1901, whereby an additional $25,000 shall be appropriated for the continuation of this most important work.

PLANS.

Field work of topographic mapping and extension of primary triangulation was resumed early in April in all the counties planned for survey. Plans were arranged during the past winter, in consultation with Mr. H. M. Wilson, geographer of the United States Geological Survey, in charge of field work in New York. In accordance with these one party was to be engaged in the extension of primary triangulation during the season from early spring to late fall, over the northern and southern Adirondack region on the counties of Fulton, Hamilton, St. Lawrence and Franklin, and small portions of Warren and Saratoga. It was also planned to run two additional lines of precise leveling for the purpose of subdividing and strengthening the net of precise leveling in the State during the season.

The plans for topographic mapping were arranged primarily with a view to mapping the largest practicable areas in the Adirondack and Catskill regions, at the instances of the Commissioners of Fisheries, Forests and Game. In addition, they provided for the extension of mapping on Long Island, to facilitate studies of water supply for Brooklyn; in Ulster and Delaware counties for the same purpose for New York city; and in the Genesee Valley for like reasons for the city of Rochester. Finally, portions of the central counties partially mapped in 1900, were planned for completion in 1901.

The result of the plans as carried out is shown in the following statement of results of operations during the field season of 1901. This report is arranged under three separate heads; namely, triangulation, precise leveling and topographic surveying. Practically all the work planned for the season was completed.

RESULTS.

Triangulation.—Primary triangulation of the State was under the general supervision of Mr. S. S. Gannett, chief of the division of triangulation and computation of the United States Geological Survey. One party under Mr. E. L. McNair, was engaged in work in the southern Adirondack and northern Adirondack regions in the six counties of Fulton, Hamilton, St. Lawrence and Franklin, and small portions of Warren and Saratoga. In all this party occupied 30 triangulation stations and determined their positions. This control covered an area of 2,000 square miles and rendered available for future topographic mapping 10 additional atlas sheets. Including areas controlled prior to this season there is now available for future topographic mapping 13,500 square miles, which will be reproduced on 60 separate atlas sheets. In the progress of this work there was established one meridian mark at the county seat of Johnstown.

Precise leveling.—The precise level party under Mr. D. H. Baldwin, assistant topographer, ran two additional lines, the first beginning at Utica, where connection was made between bench marks of the Deep Waterways Commission and Barge Canal, which organizations connect with the old U. S. Engineer bench marks at Little Falls. The line was continued along the D., L. & W. R. R. to Bridgewater, thence along the Unadilla Valley R. R. to New Berlin, and thence along the N. Y., O. & W. R. R. to a point west of Sidney, where connection was made with a bench mark established by Mr. E. L. McNair, topographer in 1899, on the line run between Dunkirk and Albany. From this point the line was continued along the N. Y., O. & W. R. R. via Walton to Hancock, near which point a connection was made with a bench mark established by Mr. C. H. Semper in 1900, on the line from McNair's bench mark at Binghamton to the United States Coast and Geodetic Survey bench mark at Poughkeepsie. The second line was begun at the United States Engineer bench mark on the lighthouse at Char-

lotte, and was continued along the B., R. & P. R. R. to Rochester, where connection was made with a bench mark of the Barge Canal and thence along the W. N. Y. & P. R. R. to Genesee Junction, where the line was discontinued. It connects with primary levels carried north from McNair's precise line. The total mileage of precise levels was 124, and this is permanently marked by 18 metal tablets.

Topographic surveying.—The various parties engaged in topographic mapping commenced field work about the middle of April. Several parties under the general supervision of Mr. Glenn S. Smith, topographer, assisted by Messrs. T. G. Basinger, Geo. H. Guerdrum, J. M. Whitman, jr., and E. G. Hamilton, assistant topographers, and by Messrs. T. F. Slaughter, W. H. L. Morey, field assistants, and by various temporary aids, completed the mapping of Cold Spring Harbor, Babylon, Santanoni and Big Moose quadrangles, and the partial mapping of Long Lake quadrangle and partial control of St. Regis quadrangle.

Several parties under Mr. J. H. Jennings, topographer, aided by Messrs. Oscar Jones, topographer; W. W. Gilbert and D. H. Baldwin, assistant topographers; Mr. Gilbert Young, field assistant, and by various temporary aids, completed the mapping of Gilboa, Kingston, Margaretville and Honeoye quadrangles. Mr. Jennings' parties also completed all traverse and level control for the future mapping of Hobart, Richmondville, Boonville and Wayland quadrangles.

A large party under Mr. A. C. Roberts, topographer, assisted by Mr. C. L. Hoopes, assistant topographer, and by several aids, completed the mapping of Lasellsville quadrangle. Later with the assistance of Mr. W. H. Lovell, topographer, this party completed the mapping of Gloversville quadrangle.

Mr. C. C. Bassett, topographer, aided for a short period by Mr. J. H. Jennings, topographer, completed the mapping of Appalachin, Binghamton, Harford and Pitcher quadrangles, the control of which was procured during the season of 1909.

Mr. W. H. Lovell, topographer, revised the Whitehall and

Fort Ann quadrangles, besides assisting in mapping Gloversville quadrangle.

In all, the final topographic mapping of 14 sheets was completed during the season, and field work of surveying 6 others was well advanced. These maps depict the topography of portions of 24 different counties; namely, Suffolk, Queens, Franklin, Essex, Herkimer, Hamilton, Schoharie, Delaware, Greene, Ulster, Monroe, Ontario, Livingston, Fulton, Broome, Tioga, Cortland, Madison, Chenango, Milton, Otsego, Lewis, Oneida and Steuben.

The resulting maps are being drawn up in office and preliminary photolithographic copies of the completed sheets will soon be ready for distribution.

The net results of the field work of the various topographic parties are summed up in the following tabular statement:

COUNTIES.	Sheet.	Topographers.	Number of days worked.	Area mapped, square miles.	Triangulation locations, number.	SPIRIT LEVELING. Bench marks, number.	SPIRIT LEVELING. Miles, number.	SPIRIT LEVELING. Elevations, number.	Traverse miles, number.	COST, FIELD WORK ONLY. Total.	COST, FIELD WORK ONLY. Per square mile.
Suffolk, Queens	Babylon	Smith, Guerdrum, Whitman, Slaughter, Hamilton	60	258	......	6	72	154	965	$2,000	......
Suffolk, Queens	Cold Spring Harbor										
Franklin, Essex	Santanoni	Smith, Guerdrum, Whitman, Slaughter, Hamilton	317	282	152	3	121	525	1,510	9,000	......
Herkimer, Hamilton	Big Moose										
Schoharie, Delaware, Greene	Gilboa	Jennings, Gilbert, Young, Baldwin	193	884	857	24	318	1,531	3,179	6,800	......
Ulster	Kingston										
Delaware, Ulster, Greene	Margaretville										
Monroe, Ontario, Livingston	Honeoye										
Herkimer, Hamilton, Fulton	Lassellsville	Roberts, Lovell, Hoopes	212	381	695	6	85	885	598	5,600	......
Hamilton, Fulton	Gloversville										
Broome, Tioga	Appalachin	Jennings, Bassett	131	771	444	......	17	269	175	1,620	......
Cortland, Madison, Chenango	Pitcher										
Cortland, Tioga, Broome	Harford										
Broome	Binghamton										
			913	2,576	2,148	39	643	3,861	6 427	$25,020	$9.70
Partly Surveyed.											
Milton, Franklin	Long Lake	Guerdrum, Basinger	114	79	104	3	58	215	785	$4,700	......
	St. Regis										
Schoharie, Delaware	Hobart	Jennings, Jones, Young	71	......	816	14	362	1,505	1,926	5,500	......
Schoharie, Delaware, Otsego	Richmondville										
Lewis, Oneida	Boonville										
Livingston, Steuben	Wayland										
			185	79	920	17	420	1,720	2,711	$10,200	......
Rutland, Washington	Whitehall Revision	Lovell	5	......	......	......	......	......		$80	......
Rutland, Washington	Fort Ann Revision										
Totals			1,103	2,655	3,068	56	1,063	5,084	9,138	$35,300	......
	Precise levels		45	......	......	18	124	96	......	......	......
Grand totals			1,148	......	......	74	1,187	5,180	......	......	......

SPIRIT LEVELING.

Ten parties were engaged under the immediate direction of the various topographers in running spirit levels over the areas under survey. This was done to determine the elevations and establish bench marks upon which to base the contour sketching of the area mapped. These levels were run with the greatest care and are all reduced to mean sea level. In the conduct of this work there were run 1,063 miles of levels, in the course of which there were established 56 permanent bench marks of bronze or aluminum.

Lengths of Level Circuits and Closure Errors, 1900.

REFERENCE DATUM.	Length of circuit, miles.	Closure errors, feet.	Levelman.
Cape Vincent	19	0.0[illegible]	William Kelly.
	14	0.066	
	14	0.003	
	32	0.001	
	51	0.755	
	43	0.104	
Albany	35	0.011	George Baily.
	17	0.063	
	35	0.355	
	68	0.477	
	36	0.200	
	36	0.182	
	52	0.027	W. E. Green,
	30	0.091	W. E. Green.
	59	0.004	C. H. Semper.
	44	0.102	
	121	0.267	
	53	0.252	
	26	9 213	J. W. Hodges.

SECONDARY LOCATIONS.

In the progress of topographic mapping horizontal control was established by plane-table triangulation and road traverse. The positions of 3,068 points were accurately determined by trigonometric methods, the elevations of which were ascertained at the same time and in the same manner. In addition, 9,138 miles of road traverse were run, and from these were located by intersection about 2,780 additional positions. The horizontal control of the maps averaged approximately one trigonometric location per square inch of map, and over three spirit elevations per square inch of map.

LAND CLASSIFICATION MAPS.

Manuscript maps showing portions of the mapped areas covered by timber, brush and cultivated crops, respectively, with appended statements of the kinds and percentage of the various woods and crops, have been prepared as heretofore.

OFFICE WORK.

During the office season of 1900-1901 all of the atlas sheets mapped during the preceding season were completely drawn up and turned over to the engravers for publication. They are still in the hands of the engravers and include the following 18 sheets, representing an area of 3,656 square miles:

SHEET NAME.	Counties.	Area square miles.
Clayton	Jefferson	202
Theresa	Jefferson	215
Grindstone	Jefferson	24
Luzerne	Warren, Saratoga	217
Alexandria Bay	Jefferson, St. Lawrence	134
Newburg	Ulster, Orange	228
Phœnicia	Ulster, Greene	222
Kinderhook	Columbia, Rensselaer	221
Canandaigua	Ontario, Monroe	219
Norwich	Chenango, Madison	220
Naples	Livingston, Yates, Steuben	220
Owego	Tioga	223
Penn Yan	Yates, Steuben	220
Hammondsport	Schuyler, Steuben, Yates	221
Richfield Springs	Montgomery, Otsego, Herkimer	219
Cortland	Cortland	220
Blue Mountain	Hamilton, Essex	216
Berne	Schoharie, Albany	220
Total		3,656

In addition there remain in the hands of the engravers the following 14 atlas sheets, maped in 1899-1900, all of which will soon be ready for publication and issuance:

SHEET NAME.	Counties.	Area square miles.
Palmyra	Wayne, Ontario	218
Clyde	Wayne, Seneca	218
Sodus Bay	Wayne	69
Weedsport	Wayne, Cayuga	218
Geneva	Ontario, Seneca	219
Phelps	Ontario, Yates	219
Ovid	Yates, Seneca	220
Genoa	Seneca, Cayuga, Tompkins	220
Millbrook	Dutchess	223
Raquette Lake	Hamilton	215
Morrisville	Madison, Oneida	219
Saratoga	Saratoga	218
Broadalbin	Fulton, Saratoga, Hamilton	218
Waverly	Chemung, Tioga	222
Total		2,916

PUBLISHED SHEETS.

At the time of the submission of my last annual report there had been published 105 atlas sheets by the office of the United States Geological Survey, covering a total of 18,824 square miles. Since then there has been completed by the engraving division of the United States Geological Survey only one additional atlas sheet, namely, Schunemunk; thus making the total number of sheets published 106, and the total published area 19,048 square miles.

The engraving, printing, issuance and sale of these maps is done exclusively at the expense of and by the United States Geological Survey. Such limited number of proofs as may be required by the office of the State Engineer are furnished for his use. Others desiring these maps can obtain them by addressing the director of the United States Geological Survey at Washington, D. C., and enclosing five cents per copy, or at the rate of $2 per hundred. Upon the accompanying progress map is indicated such portions of the State as have been surveyed, including, however, all those which are not engraved and published.

NEW YORK.

TRIANGULATION OF 1900.

During the season of 1900, April to October, four parties were engaged on triangulation in New York under the general supervision of Mr. S. S. Gannett. In the central portion of the State a belt of triangulation was extended by Messrs. Griswold and McNair from Virgil-Warren eastward to Utsayantha-Otsego stations of the Gardiner State Survey. In the south-eastern portion of the State, the work of the United States Coast and Geodetic Survey, was extended northward by Oscar Jones, assistant topographer, from stations Bearfort, High Point, Hamburg and High Torne connecting with the work of Mr. McNair at stations Andres, Brainley, Utsayantha.

During the summer months Mr. McNair was transferred to the Adirondack region where he controlled six 15′ quadrangles by triangulation based upon Blue-Vanderwhacker. Twelve stations were occupied and six points located by intersections. During September he ran a line of primary traverse from Ogdensburg lighthouse (located by the United States Lake Survey) to Churubusco and Owl's Head (triangulation stations of the United States Geological Survey), with several spur lines; a total distance of 142 miles, and furnished control for five 15′ quadrangles.

Mr. S. Tatum, topographer, extended triangulation northward from Penn-Myer, occupying nine stations, and also occupied and located one station, Webb, from West and Mt. Morris; the total number of quadrangles controlled being four.

The net results of the season's work being the occupation of 70 triangulation stations and the running of 142 miles of primary traverse, controlling 44 quadrangles in portions of the counties of Orange, Sullivan, Ulster, Delaware, Otsego, Oneida, Madison, Chenango, Cortland, Broome, Herkimer, Essex, Hamilton, Franklin, Clinton, Lewis, St. Lawrence. Meridian lines were established at Goshen, Delhi, Cooperstown, Utica, Hamilton, Norwich, Binghamton and Malone.

ALDER, HERKIMER COUNTY, N. Y.

On Alder Creek mountain about 23 miles east of Lowville and 5 miles northeast of Number Four P. O. Can be reached by following Alder Creek trail northeast from Number Four P. O about 3 miles, thence east 2 miles to signal.

Station mark: A copper bolt cemented in solid rock.

Latitude, 43° 54′ 30.68″. Longitude, 75° 08′ 23.79″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Schwartz	27 39 52.0	207 32 12.2	4.5061384
Gum	43 37 18.7	223 23 05.7	4.6025859
Rock	52 18 27.6	232 09 09.7	4.3572002
Elmer	77 08 05.2	256 49 08.1	4.5752192
Stillwater	301 19 41.7	121 24 06.2	3.9989646

AMPERSAND, FRANKLIN COUNTY, N. Y.

(Not occupied.)

A bare, rocky mountain in the southeastern corner of Franklin county, on the north side of Ampersand pond. Can be easily reached from Ampersand pond.

Station mark: Probably a bolt of the N. Y. S. Land Survey.

Latitude, 44° 14′ 04.68″. Longitude, 74° 12′ 11.35″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Morris	69 11 42	249 00 18	4.36771
Hayes	87 26 27	267 16 25	4.28293
St. Regis	152 24 35	332 19 16	4.33909
McKenzie	230 14 03	50 21 12	4.24787
Moose Peak	230 48 13	50 26 33	4.31103
McIntyre	300 16 49	120 25 51	4.30128
Seward	358 17 48	178 17 56	3.92014

ANDES, DELAWARE COUNTY, N. Y.

On a prominent timbered mountain locally called Mt. Pisgah, in town of Andes, and owned by Elliott Graham. Most of the timber was cut down in 1900 and one birch tree left for a signal.

Station mark: A bronze triangulation tablet cemented in a large flat boulder on highest point of mountain.

Reference mark: The birch signal tree; true azimuth, mark to tree 110° 04′, distance 57.0 feet.

Latitude, 42° 13′ 16.81″. Longitude, 74° 44′ 11.38″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Deyoe	13 43 09.3	193 40 46.2	4.3157762
Butternut	123 27 10.9	303 06 51.2	4.6953369
Bramley	141 24 30.8	321 21 12.8	4.0337993
Meredith	145 37 50.7	325 31 02.4	4.3904270
Utsayantha	211 25 15.0	31 31 09.9	4.3641901
Slide	310 18 47.4	130 32 52.6	4.5803074
Graham	322 31 31.2	142 39 02.3	4.4051606
Willis	87 13 22.4	266 48 12.8	4.7127779

AVERILL, CLINTON COUNTY, N. Y.

On a high cleared mountain about 3 miles southeast of Lyon Mountain station on Chateaugay Railway.

Station mark: A copper bolt set in solid rock and marked "Adirondack Survey-V. C. 33."

Latitude, 44° 41′ 34.68″. Longitude, 73° 52′ 52.722″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Moose Peak	14 27 33.2	194 22 22.9	4.5938655
Lookout	45 48 07.8	225 41 01.8	4.2709061
Debar	69 52 33.0	249 38 13.6	4.4582297
Owls Head (2)	104 23 30.2	284 11 44.7	4.3573876

AZURE, FRANKLIN COUNTY, N. Y.

On a cleared mountain locally known as Blue Mountain about 4 miles southwest from Spring Cove station on the New York and Ottawa Railway. A good trail from Blue Mountain House to the summit.

Station mark: A bronze tablet cemented in solid rock marked "U. S. Geological Survey, New York."

Latitude, 44° 32′ 28.19″. Longitude, 74° 30′ 04.51″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Duane M. E. Church	235 06 10.5	55 16 13.0	4.3625900
Debar	252 36 30.5	72 48 18.5	4.3676167
Rice	284 44 03.0	104 50 29.0	4.0980000
St. Regis	317 10 02.2	137 12 13.9	4.3022069
Morris	357 14 03.2	177 15 07.4	4.6276584

BEADLE, CHENANGO COUNTY, N. Y.

On a bare hill in Smithville township 1½ miles northwest of Smithville Flats on land belonging to H. C. Beadle.

Station mark: A bluestone post 30 by 7 by 7 inches set 30

inches in the ground in the center of top of which is cemented a bronze triangulation tablet.

Latitude, 42° 24′ 00.40″. Longitude, 75° 47′ 01.60″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
McDonough	178 31 48.5	358 31 39.9	4.0396390
Berry	204 44 20.5	24 48 07.4	4.2628410
Bobell	328 49 36.8	148 53 45.9	4.2141530

BEARFORT, PASSAIC COUNTY, N. J.

A station of the U. S. Coast and Geodetic Survey on a high summit of Bearfort mountain, about 2 miles southwesterly from road leading over mountain from Greenwood lake to Vernon.

Station mark: A copper bolt ¾ inch in diameter projecting about ¾ inch above rock.

Latitude, 41° 08′ 26.09″. Longitude, 74° 23′ 31.35″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Hamburg	94 11 30.7	274 06 02.8	4.0664557
High Point	131 36 05.8	311 25 25.5	4.4802442
Eve	173 54 55.4	353 54 01.4	4.2549964
Sterling	223 29 43.8	43 35 48.2	4.2720153
High Torne	266 19 23.1	86 28 25.3	4.2845292
Bald Hill	350 10 07.9	170 11 44.9	4.3060559

BERRY, CHENANGO COUNTY, N. Y.

A station of the New York State Survey on the town line between Pharsalia and McDonough, 1½ miles east of East Pharsalia.

Station mark: A granite post marked "N. Y. S. S. 381."

Latitude, 42° 32′ 59.40″. Longitude, 75° 41′ 25.64″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Virgil	80 25 34.2	260 07 19.8	4.5740224
Solon	109 51 50.1	289 39 49.6	4.4115321
Smyrna	190 27 53.7	10 29 21.3	4.2100631
Sherburne	246 12 35.3	66 23 09.5	4.3680101
Whitcomb	310 49 06.8	130 56 19.9	4.2869705
Bobell	358 32 53.2	178 33 16.1	4.4865173

BLOODY POND, CORTLAND COUNTY, N. Y.

A secondary station in the northwest corner of the town of Willet on the highest point of the hill to the northwest of Bloody Pond.

Station mark: A cut marble post 30 by 6 by 6 inches set 30 inches in the ground, in the center of top of which is cemented a bronze triangulation tablet marked "New York 519."

Latitude, 42° 29′ 21.22″. Longitude, 75° 57′ 38.14″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Berry	253 02 15.6	73 13 12.8	4.3654326
Bobell	315 59 36.7	136 10 55.1	4.5210775

BOBELL, CHENANGO COUNTY, N. Y.

A station of the New York State Survey situated on the highest point of a bare hill in the town of Coventry, 4 miles south and 1 mile east of the village.

Station mark: A granite post of the New York State Survey marked "N. Y. S. S. 390."

Latitude, 42° 16′ 26.186″. Longitude, 75° 40′ 51.75″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Windsor	15 53 33.8	195 50 55.6	4.2956850
Maine	76 38 30.0	256 26 28.6	4.4029914
Virgil	122 53 27.9	302 34 53.6	4.6527993
Berry	178 33 16.1	358 32 53.2	4.4865173
Whitcomb	217 39 09.0	37 45 58.1	4.3564016
Willis	287 46 26.2	107 59 21.4	4.4438558
Butternut	239 25 01.1	59 42 52.4	4.6251388

BOONVILLE, ONEIDA COUNTY, N. Y.

A high cleared hill in Boonville park.

Station mark: Flagstaff in park.

Latitude, 43° 28′ 47.61″. Longitude, 75° 19′ 23.79″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Myers	270 41 15.1	90 50 27.0	4.2559318
Penn	335 19 05.8	155 21 42.2	4.0885049

BRAMLEY, DELAWARE COUNTY, N. Y.

On a high, bare ridge in Delhi township, 2½ miles south of Bloomville, on land owned by S. G. Bramley.

Station mark: A bronze triangulation tablet cemented in solid rock, 6 inches below surface of ground.

Latitude, 42° 17′ 50.53″. Longitude, 74° 49′ 06.72″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Starkweather	45 38 13.7	225 28 50.9	4.4299297
Loomis	76 02 60.0	255 47 35.1	4.5118611
Meredith	148 52 42.2	328 49 11.8	4.1403248
Utsayantha	238 57 34.9	59 06 48.4	4.3410478
Andes	321 21 12.8	141 24 30.8	4.0837993
Deyoe	356 16 00.3	176 16 54.6	4.4564693
Persons	113 30 42.9	293 21 14.0	4.3237562

BUTTERNUT, OTSEGO COUNTY, N. Y.

On a cleared knob in Butternut township, owned by Walter Wood and occupied by Mr. Foote.

Station mark: A marble post 36 by 6 by 6 inches, set 32 inches in the ground, in the center of top of which is cemented a bronze triangulation tablet marked "New York 517."

Latitude, 42° 27′ 58.70″. Longitude, 75° 14′ 22.18″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Willis	18 30 41.8	198 25 48.0	4.4986447
Bobell	59 42 52.4	239 25 01.1	4.6251388
Whitcomb	81 29 42.1	261 18 39.1	4.3560978
Sherburne	140 03 35.8	319 55 51.7	4.3866556
Telford	195 38 15.2	15 42 04.0	4.4555214
Meredith	284 02 38.0	104 16 10.6	4.4531355
Andes	303 06 51.2	123 27 10.9	4.6953269

CROGHAN, LEWIS COUNTY, N. Y.

Catholic church in the village of Croghan.

Station mark: Stone tower on church.

Latitude, 43° 53′ 31.64″. Longitude, 75° 23′ 28.71″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Gum	....	....	4.4501863
Elmer	68 01 58.6	247 53 28.7	4.2486477
Rock	349 36 07.9	169 37 16.7	4.0906550

DEBAR, FRANKLIN COUNTY, N. Y.

A high cleared mountain in Duane township about 4 miles south of Duane P. O. Best reached from Debar pond on northeast side of mountain. No trail.

Station mark: A bronze triangulation tablet cemented in solid rock and marked "U. S. Geological Survey, New York."

Latitude, 44° 36′ 12.7″. Longitude, 74° 13′ 15.66″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
St. Regis	21 52 12.9	201 47 37.7	4.3678052
Rice	45 07 15.0	225 01 52.0	4.1566600
Azure	72 48 18.5	252 36 30.5	4.3676107
Owl's Head (2)	197 18 09.0	17 20 43.9	4.2121883
Averill	249 38 13.6	69 52 33.0	4.4582297
Lookout	282 42 51.5	102 50 04.4	4.1444627
Moose Peak	328 21 42.8	148 30 49.6	4.5178874
Duane M. E. Church	151 53 58.0	331 52 12.0	3.8487800

DENMAN, SULLIVAN COUNTY, N. Y.
(Not occupied.)

In Neversink township, on a high timbered ridge known as Denman mountain, 1¼ miles east of Clarysville P. O., on land owned by Leonard Moore, who lives one-half mile west of station.

Station mark: A copper bolt set in bowlder 10 by 10 by 8 feet on highest point of mountain and the only bowlder on top.

Reference mark: The birch signal tree N. 68° E. (true) 20.8 feet distant.

Latitude, 41° 54′ 14.53″. Longitude, 74° 32′ 26.14″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Walnut	55 55 20.6	235 46 10.1	4.3618317
Graham	....	....	4.1781101
Sam's Point	329 24 36.5	149 31 57.0	4.4778895
South Hill	346 09 17.6	166 10 19.4	3.9500513

DEYOE, DELAWARE COUNTY, N. Y.

On a heavily timbered ridge, property of New York State, 2 miles northwest of Lewbeach P. O.

Best reached from Rockland, a station on the New York, Ontario and Western Ry. E. D. Deyoe lives 1 mile south of station.

Theodolite elevated 25 feet on stump of tree.

Station mark: Stump of maple tree 18 inches in diameter, 25 feet high. Six lines have been cut through timber to as many different stations.

Latitude, 42° 02′ 25.29″. Longitude, 74° 47′ 44.73″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Maulik	38 13 30.4	218 07 04.3	4.3326300
Starkweather	114 46 08.0	294 35 52.3	4.3661821
Bramley	176 16 54.6	356 16 00.3	4.4564693
Andes	193 40 46.2	13 43 09.3	4.3157762
Graham	270 09 54.3	90 19 47.4	4.3090438
Walnut	355 36 17.2	175 37 19.6	4.4493156

DUANE, M. E. CHURCH, FRANKLIN COUNTY, N. Y.

(Not occupied.)

Situated in Duane township near Duane P. O.

Station mark: Center of church spire.

Latitude, 44° 39′ 34.43″. Longitude, 74° 15′ 46.59″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Azure	55 16 13	235 06 10	4.36259
Debar	331 52 12	151 53 58	3.84878

ELMER, LEWIS COUNTY, N. Y.

Seven miles southwest of Lowville, in town of Harrisburg, 1 mile south of Harrisburg post-office, on land owned by E. P. Elmer.

Station mark: A marble post 48 by 8 by 8 inches set flush with surface of ground, and in center of top is cemented a bronze triangulation tablet.

Latitude, 43° 49′ 56.12″. Longitude, 75° 35′ 44.54″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Croghan	247 53 28.7	68 01 58.6	4.2486477
Alder	256 49 08.1	77 08 05.2	4.5752192
Rock	286 14 32.9	106 24 11.0	4.2890136
Schwartz	312 18 58.8	132 30 13.8	4.4710612

ELY, BROOME COUNTY, N. Y.

An observation tower on the first hill northwest of the city of Binghamton.

Station mark: Center of observatory.

Reference marks: A granite post 48 by 6 by 6 inches set 42 inches in the ground, 35 feet south of observatory, and marked "N. Y. S. S. 417."

Latitude, 42° 07′ 11.47″. Longitude, 75° 55′ 14.10″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Maine	156 42 55.5	336 40 34.0	4.0872424
Windsor	277 24 41.8	97 31 41.6	4.1620909

EVE, ORANGE COUNTY, N. Y.

On the western end of a partly cleared ridge in Warwick township, 2½ miles from Hudson, a station on the Lehigh and Hudson R. R. Land owned by James Henry, who lives 400 yards north of station and at foot of mountain.

Station mark: A copper bolt stamped "U. S. G. S." set in solid rock.

Reference marks: Azimuth 30°, distance 24.25 feet to arrow cut in ledge on top of ridge. Azimuth 194°, distance 39.55 feet to arrow cut in ledge on top of ridge. Azimuth 320°, distance 81.68 feet to arrow cut in flat stone, level with surface and 70 feet below station.

Latitude, 41° 18′ 05.92″. Longitude, 74° 24′ 53.31″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
High Point	95 59 11.4	275 49 24.2	4.3181160
Writer	139 13 21.5	319 07 01.4	4.3105577
Vernon	160 21 29.5	340 17 30.6	4.3964954
Houston	192 27 20.4	12 29 31.5	4.3289821
Sterling	286 15 41.1	106 22 40.1	4.1875280
Bearfort	353 54 01.4	173 54 55.4	4.2549964

GRAHAM, ULSTER COUNTY, N. Y.

On Graham mountain, Hardenburg township, 3 miles south of Seager post-office, and best reached from Arkville station, on the Ulster and Delaware Railroad. The highest point is very sharp and covered with low brush, most of which was cut down in 1900. Land owned by George J. Gould, of New York city.

Station mark: A copper bolt in flat bowlder.

Latitude, 42° 02′ 22.44″. Longitude, 74° 32′ 58.99″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Walnut	33 12 47.2	213 08 57.9	4.5237748
Deyoe	90 19 47.4	270 09 54.3	4.3090438
Andes	142 39 02.3	322 31 31.2	4.4051606
Utsayantha	175 14 48.4	355 13 10.9	4.6026806
Slide	288 16 41.6	108 23 15.3	4.1539652
Sam's Point	338 34 47.4	158 42 30.5	4.6430438

GUM, LEWIS COUNTY, N. Y.

On a high cleared point in Turin township, about 4 miles northwest of Turin village, on land owned by Thomas Evans, who lives 2,000 feet east of station.

Station mark: A stone post 48 by 8 by 8 inches set flush with surface of ground, and in the center of top is cemented a bronze triangulation tablet.

Latitude, 43° 38′ 49.46″. Longitude, 75° 28′ 56.60″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Rock	212 18 07.9	32 23 03.2	4.2524113
Alder	223 23 05.7	43 37 16.7	4.6025839
Stillwater	236 23 57.4	56 42 33.8	4.6363342
Schwartz	267 08 48.6	87 15 20.8	4.1055027
Myers	301 14 26.1	121 30 13.6	4.5579931
Penn	328 45 18.0	148 54 29.0	4.5407023

HAMBURG, SUSSEX COUNTY, N. J.

A station of the United States Coast and Geodetic Survey.

Situated on the Hamburg mountains, in the town of Hardiston, about 3 miles S. 76° E. from the village of Hamburg, on the N. Y., S. and W. Ry., about one-half mile S. 38° W. from dam at outlet of Sand Pond, and on land owned by the Franklin Iron Co.

Station mark: A copper bolt three-quarters inch in diameter and 4 inches long, set in solid rock with one-half inch projecting; also by letters "G. S. of N. J." cut in rock on southwest side of bolt.

Latitude, 41° 08′ 53.40″. Longitude, 74° 31′ 49.75″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
High Point	150 10 25.4	330 05 13.6	4.3448511
Bearfort	274 06 02.8	94 11 30.7	4.0664557
Bald Hill	323 57 21.7	144 04 26.1	4.4095860

HAYES, FRANKLIN COUNTY, N. Y.

Located about 1 mile northeast of Tupper Lake village in an open field on a large bowlder 12 by 8 by 8 feet near hay barn and in the rear of a small log building. Land is owned by D. J. Hayes, liveryman, of Tupper Lake. Station located by three-point method.

Station mark: A bronze triangulation tablet cemented in solid rock, marked "U. S. Geological Survey, New York."

Latitude, 41° 13′ 35.99″. Longitude, 74° 26′ 34.80″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
St. Regis	203 57 51.0	24 02 35.0	4.34522
Ampersand	267 16 25.0	87 26 27.5	4.28293
Mt. Morris	19 21 29.5	199 20 08.0	3.89649

HIGH POINT, SUSSEX COUNTY, N. J.

A station of the United States Coast and Geodetic Survey in Montague township, 4 miles south of Port Jervis, on the highest point in the State.

Station mark: A copper bolt set in solid rock.

Latitude, 41° 19′ 15.29″. Longitude, 74° 39′ 42.86″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Walnut	170 11 06.9	350 06 48.2	4.7211823
Roads	187 27 33.4	7 29 02.6	4.3817799
Wolf	191 50 44.3	11 53 48.5	4.4968100
Writer	208 41 57.3	28 45 25.1	4.1818277
Vernon	209 52 18.3	29 58 07.8	4.3909515
Sam's Point	213 07 28.5	33 19 35.9	4.5672123
Houston	233 25 04.0	53 37 03.5	4.4973076
Rye	275 49 24.2	95 59 11.4	4.3151160
Sterling	280 11 22.0	100 28 18.1	4.5570629
Bearfort	311 25 25.5	131 36 05.8	4.4982442
Hamburg	330 06 23.6	150 10 25.4	4.3448521

HIGH TORNE, ROCKLAND COUNTY, N. Y.

A station on the United States Coast and Geodetic Survey in Ramapo township, about 1 mile northeast from Ramapo station, on the N. Y., L. E. and W. R. R., on the summit of a prominent elevation known as High Torne, which falls off abruptly on the southeast end. Station is about 115 paces northeast from a large cliff. Land is owned by H. I. Pierson, of Ramapo.

Station mark: A three-quarter inch bolt cemented in solid rock.

Latitude, [illegible]. Longitude, [illegible].

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

HOOKER, OTSEGO COUNTY, N. Y.

On a high bare knob in Maryland township, 3½ miles west of Schenevus, on land owned by E. D. Hooker (P. O. Westville).

Station mark: A granite post 48 by 6 by 6 inches, set 42 inches in the ground, marked "N. Y. S. S. 409."

Latitude, 42° 35′ 43.00″. Longitude, 74° 51′ 53.44″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Meredith	8 49 50.2	188 48 12.6	4.3329191
Telford	119 50 46.5	299 39 21.7	4.4234765
Wart	134 54 35.7	314 48 24.9	4.2450464
Utsayantha	313 53 52.2	134 05 00.6	4.4969808

HOUSTON, ORANGE COUNTY, N. Y.

On a cleared hill in Wallkill township, one-half mile north of Scotchtown post-office, on land owned by Robert Houston, who lives in Middletown, N. Y. Harry Smith, renter, lives 300 yards south of station. A good view in all directions.

Station mark: A stone post 20 by 8 by 8 inches, set flush with the surface of ground, in center of top of which is cemented a bronze triangulation tablet.

Reference marks: Azimuth 185°, distance 119.85 feet to a large stone pile in fence corner. Azimuth 340°, distance 164.73 feet to arrow cut in white rock 3 by 2 by 1 foot above ground, arrow in north end of bowlder. Azimuth 23°, distance 242.22 feet to arrow cut in north end of rock ledge 10 by 4 by 1 foot above ground. Azimuth 90°, distance 60 feet to stone wall.

Latitude, 41° 29′ 20.99″. Longitude, 74° 21′ 35.00″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Eve	12 29 31.5	192 27 20.4	4.3289821
High Point	53 37 03.5	233 25 04.0	4.4973076
Writer	73 27 08.3	253 18 36.1	4.2725795
Vernon	101 32 05.0	281 25 54.3	4.1219453
Sam's Point	180 39 16.9	0 39 23.5	4.3051821
Sterling	337 59 03.7	158 03 52.5	4.4333572

KEMPSHALL, HAMILTON COUNTY, N. Y.

A heavily timbered mountain in the town of Long Lake, on the east side of Long Lake, two miles south of Island Hotel. Lines are cleared through timber to Blue Mountain, West Moun-

tain, Nigger Head, Owls Head, Mt. Morris, Mt. St. Regis and Mt. Ampersand.

Theodolite elevated 20 feet on trunk of tree.

Station mark: Center of trunk of tree 2 feet in diameter cut off 20 feet from ground. Station No. 493.

Reference mark: A copper bolt set in a bowlder 2½ feet in diameter imbedded in the roots of trunk, bolt being 2 feet northwest of center of tree.

Latitude, 44° 01′ 28.43″. Longitude, 74° 19′ 48.97″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Blue	18 42 04.4	198 39 06.6	4.2512882
West	58 57 16.0	238 41 35.4	4.5481265
Morris	142 16 28.2	322 10 24.0	4.2789159

KNACK, SULLIVAN COUNTY, N. Y.

In Delaware township on a partially cleared ridge 2 miles west of the village of Jeffersonville on land owned by Peter Knack who lives two hundred yards east of station.

Station mark: A bronze triangulation tablet cemented in solid rock, 4 by 3 by 1 foot exposed.

Reference marks: Azimuth 105°, distance 33 feet to arrow cut in rock 10 by 15 by 2 feet exposed. Azimuth 47°, distance 75 feet to arrow cut in rock on east side of ridge. Azimuth 34°, distance 70 feet to arrow cut in rock very little above surface.

Latitude, 41° 47′ 37.88″. Longitude, 74° 58′ 51.35″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Maulik	191 07 32.3	11 08 31.8	4.0280701
Walnut	272 08 34.4	92 17 00.9	4.2445692
White Lake	318 35 05.6	138 40 50.0	4.2574751

LITCHFIELD, HERKIMER COUNTY, N. Y.

In Litchfield township, one-half mile north of Jerusalem church, on a cultivated bare hill owned by H. Wheelock.

Station mark: A stone post 30 by 8 by 6 inches, set 28 inches in the ground, in the center of top of which is cemented a bronze triangulation tablet.

Latitude, 42° 59′ 05.65″. Longitude, 75° 08′ 44.165″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Plainfield	10 08 22.7	190 01 40.3	4.2918608
Tassel	70 59 08.1	250 52 08.1	4.1696687
Schuyler	186 52 09.4	6 53 21.2	4.2975436

Lookout, Franklin County, N. Y.

A bare rocky mountain about 2 miles east of Loon Lake. Can be reached from Loon Lake House by trail in about 1½ hours, or from Loon Lake station by road and trail in about same time.

Station mark: A bronze triangulation tablet cemented in solid rock and marked "U. S. Geological Survey, New York."

Latitude, 44° 34′ 32.805″. Longitude, 74° 02′ 59.054″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
St. Regis	50 18 59.7	230 07 12.4	4.4626659
Debar	102 50 04.4	282 42 51.5	4.1444627
Owls Head (2)	154 56 52.4	334 52 13.9	4.3135926
Averill	225 41 01.8	45 48 07.8	4.2709061
Moose Peak	351 44 22.7	171 46 17.4	4.4023504
McKenzie	357 03 40.0	177 04 23.0	4.4265300

Loomis, Delaware County, N. Y.

On a partially cleared ridge in Walton township about 5 miles northwest of Walton and three-quarters of a mile north of Loomis post-office. Land owned by Mr. Allen of Walton.

Station mark: A copper bolt set in bowlder level with surface of ground.

Reference marks: Azimuth 194°, distance 664.30 feet to a 6-inch spike driven in center of blaze on lone wild cherry tree in field. Azimuth 346°, distance 123.35 feet to a 6-inch spike driven in blaze on oak tree 8 inches in diameter.

Latitude, 42° 13′ 34.33″. Longitude, 75° 12′ 01.02″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Rockrift	9 16 17.1	189 15 12.3	4.1384968
Willis	76 20 58.7	256 14 30.8	4.1345778
Meredith	230 52 57.0	51 04 52.6	4.4960309
Bramley	255 47 35.1	76 02 60.0	4.5118611
Starkweather	311 30 03.7	131 36 04.7	4.2172014

MAINE, BROOME COUNTY, N. Y.

A station of the New York State Survey on a bare hill in the eastern part of the town of Maine.

Station mark: A granite post 48 by 6 by 6 inches marked "N. Y. S. S. 398."

Latitude, 42° 13′ 15.35″. Longitude, 75° 58′ 44.81″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Virgil	156 19 15.5	336 12 44.6	4.5183599
Bobell	256 26 28.6	76 38 30.0	4.4029914
Windsor	304 13 21.2	124 22 43.3	4.3663693
Ely	336 40 34.0	156 42 55.5	4.0872424

MARCY, ESSEX COUNTY, N. Y.

A high bare mountain, the highest in the Adirondacks, in the western part of Keene township. A good trail from Adirondack Lodge (9 miles) and one from the Ausable lakes, about the same distance.

Station mark: A copper bolt in solid rock marked "Station No. 1 N. Y. S. Adirondack Mtn. Survey."

Latitude, 44° 06′ 46.102″. Longitude, 73° 55′ 26.990″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Vanderwhacker	30 08 51.4	210 01 40.7	4.4401357
Blue	55 16 19.8	234 56 26.4	4.6690929
Seward	103 23 59.8	283 12 28.2	4.3557847
McIntyre	124 11 47.0	304 09 09.0	3.7850100
Moose Peak	166 25 55.8	346 22 34.7	4.4347725

MAULIK, SULLIVAN COUNTY, N. Y.

On a partially cleared ridge in Freemont township, 3 miles southwest of Rockland village on the New York, Ontario and Western Railway, on land owned by John Maulik, who lives one quarter mile southwest of station.

Station mark: Center of maple tree, 2 feet in diameter, cut off for instrument support 28 feet above ground.

Reference marks: Azimuth 322°, distance 7.86 feet to arrow cut in large bowlder. Azimuth 81°, distance 75.77 feet to arrow cut in ledge, south side of ridge. Azimuth 166°, distance 49.87 feet to arrow cut in flat bowlder.

Latitude, 41° 53′ 17.14″. Longitude, 74° 57′ 22.07″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Knack	11 08 31.8	191 07 32.3	4.0230701
Deyoe	218 07 04.3	38 13 30.4	4.3326800
Walnut	305 41 52.5	125 49 19.9	4.2803796
White Lake	337 36 38.2	157 41 23.4	4.4149285

McDONOUGH, CHENANGO COUNTY, N. Y.

A secondary station, on a comparatively low hill in McDonough township, about 10 miles west of Oxford and one-half mile west of McDonough village on land owned by Geo. Jones. The view is partly cut off by timber and higher hills.

Station mark: A pole 6 inches in diameter set in ground and resting on a bowlder 18 inches under ground. A triangle is cut on upper surface of bowlder.

Reference marks: A stone wall east 266 feet; a stone wall west 204 feet.

Latitude, 42° 29′ 55.38″. Longitude, 75° 47′ 13.87″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Berry	234 25 26.9	64 29 22.2	3.9898161
Bobell	340 40 10.4	160 44 28.0	4.4224870
Beadle	358 31 39.9	178 31 48.5	4.0396390

McINTYRE, ESSEX COUNTY, N. Y.

(Not occupied.)

A very high bald mountain in the southern part of North Elba township.

Station mark: Probably a bolt of the New York State Land Survey.

Latitude, 44° 08′ 37.04″. Longitude, 73° 59′ 13.82″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Vanderwhacker	17 50 39	197 46 05	4.45689
Seward	96 05 50	275 56 56	4.23366
Ampersand	120 25 51	300 16 49	4.30128
Moose Peak	176 37 12	356 36 30	4.36299
Marcy	304 09 09	124 11 47	3.78501

McKENZIE, ESSEX COUNTY, N. Y.

(Not occupied.)

A high cleared mountain in northwestern part of Essex county, about 3 miles northwest of Lake Placid.

Station mark: Probably a bolt of New York State Land Survey.

Latitude, 44° 20′ 10.91″. Longitude, 74° 01′ 57.39″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Seward	34 20 28.0	214 13 28.0	4.37553
Ampersand	50 21 12.0	230 14 03.0	4.24787
St. Regis	108 49 40.0	288 37 11.0	4.39356
Lookout	177 04 23.0	357 03 40.0	4.42552
Moose Peak	234 33 19.5	54 34 31.0	3.44358
Marcy	340 43 55.5	160 48 28.0	4.42010

MEREDITH, DELAWARE COUNTY, N. Y.

On a high bare knob about two miles southwest of East Meredith, in Meredith township, on land belonging to Finley Gilchrist.

Station mark: A marble post, 28 by 6 by 6 inches, set 24 inches in the ground, in the center of top of which is cemented a bronze triangulation tablet.

Latitude, 42° 24′ 13.69″. Longitude, 74° 54′ 17.93″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Willis	58 43 52.5	238 25 28.4	4.6437372
Starkweather	21 29 20.3	201 23 26.9	4.5177814
Loomis	51 04 52.6	230 52 57.0	4.4960309
Butternut	104 16 10.6	284 02 38.0	4.4531356
Telford	150 13 42.7	330 03 56.9	4.5987214
Hooker	188 48 12.6	8 49 50.2	4.3829191
Utsayantha	271 05 06.7	91 17 51.2	4.4138399
Andes	325 31 02.4	145 37 50.7	4.3904270
Bramley	328 49 11.8	148 52 42.2	4.1403248

MONTICELLO, SULLIVAN COUNTY, N. Y.

(Not occupied.)

Station mark: Stand pipe at Monticello.

Latitude, 41° 39′ 32.12″. Longitude, 74° 40′ 57.31″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Sam's Point	267 04 09.7	87 17 09.0	4.4338327
Wolf	309 50 25.2	129 54 19.4	4.0263466

MOODY, FRANKLIN COUNTY, N. Y.

(Not occupied.)

A low bare point on the east side of Big Tupper Lake in the southwest corner of Franklin county.

Station mark: A bolt of the N. Y. State Land Survey.

Latitude, 44° 11′ 23.01″. Longitude, 74° 29′ 25.52″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
St. Regis	207 41 01	27 47 44	4.43917
Morris	340 27 37	160 28 14	3.54793

MOOSE PEAK, ESSEX COUNTY, N. Y.

On a high cleared mountain in the northwestern part of Essex county on the north side of Lake Placid. There is a good trail from the Lake Placid side.

Station mark: A half inch hole drilled in bowlder.

Latitude, 44° 21′ 03.058″. Longitude, 74° 00′ 15.23″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Seward	36 26 49.6	216 18 37.6	4.4210862
Ampersand	50 26 33.0	230 48 13.0	4.3110300
McKenzie	54 34 31.0	234 33 19.5	3.4435800
Morris	60 44 41.0	240 24 56.6	4.6357242
St. Regis	104 00 49.1	283 47 08.7	4.4273632
Debar	148 30 49.6	328 21 42.8	4.5178374
Lookout	171 46 17.4	351 44 22.7	4.4023504
Averill	194 22 22.9	14 27 33.2	4.5938655
Marcy	346 22 34.7	166 25 55.8	4.4347725

MORRIS, FRANKLIN COUNTY, N. Y.

A high bald mountain in south end of Waverly township. 4 miles east of Big Tupper Lake and 6 miles south of Tupper Lake village. Best reached by driving from Tupper Lake village to Waukesha Hotel, thence by logging road and dim trail to summit of mountain.

Station mark: Aluminum bolt of New York State Land Survey set in solid rock, also copper bolt 1 inch in diameter set in solid rock and stamped "U. S. G. S. N. Y. 497," 9⅝ inches distant from State Land Survey bolt. Position computed is that of State Land Survey bolt.

Latitude, 44° 09′ 35.18″. Longitude, 74° 28′ 32.37″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
West	29 10 08.7	209 00 30.7	4.5811562
Moody	160 28 14.0	340 27 37.0	3.5479300
Azure	177 15 07.4	357 14 03.2	4.6276534
Rice	194 25 56.0	14 31 17.0	4.6070600
Hayes	199 20 08.0	19 21 30.0	3.8964900
St. Regis	202 44 15.1	22 50 21.0	4.4771258
Moose Peak	240 24 56.6	60 44 41.0	4.6357242
Ampersand	249 00 18.0	69 11 42.0	4.3677100
Seward	269 53 53.6	90 05 24.8	4.3433268
Vanderwhacker	313 34 05.6	133 49 54.6	4.6233473
Blue	349 24 34.2	169 27 39.9	4.5114860
Kempshall	322 10 24.0	142 16 28.2	4.2789159

MYERS, ONEIDA COUNTY, N. Y.

A low partially cleared hill about 6 miles northeast of Forestport, locally known as "Myers Hill." The Herkimer-Oneida county line passes over the hill about 1000 feet east of station.

Station mark: A copper bolt marked "U. S. G. S. N. Y. 487" set in solid rock.

Latitude, 43° 28′ 39.82″. Longitude, 75° 06′ 01.72″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Schuyler	2 07 08.5	182 06 29.1	4.5450250
Penn	49 54 30.9	229 47 55.8	4.2281188
Boonville	90 50 27.0	270 41 15.1	4.2559318
Gum	121 30 13.6	301 14 26.1	4.5579931
Schwartz	137 06 45.4	316 57 29.4	4.4242541

OTSEGO, OTSEGO COUNTY, N. Y.

A station of the United States Coast and Geodetic Survey and of the New York State Survey, in Cherry Valley township, 3 miles east from the village.

Station mark: A granite post, 48 by 6 by 6 inches, marked "N. Y. S. S. 26," set 42 inches in the ground.

Latitude, 42° 46′ 54.73″. Longitude, 74° 42′ 14.60″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Wart	72 05 40.2	251 52 56.0	4.4302101
Telford	78 19 18.7	258 01 19.8	4.5674238
Tassel Hill	109 41 58.7	289 16 58.2	4.7252676
Utsayantha	347 33 08.8	167 37 46.6	4.6390267

OWL'S HEAD (2), FRANKLIN COUNTY, N. Y.

On a rocky point about one-half mile northeast of Owls Head station on Mohawk and Malone Railway. Ridge is considerably higher to north. View cut off from north to east.

Station mark: A copper bolt leaded in rock marked "U. S. G. S."

Latitude, 44° 44′ 36.81″. Longitude, 74° 09′ 35.30″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Debar	17 20 43.9	197 18 09.0	4.2121883
Averill	284 11 44.7	104 23 30.2	4.3573875
Lookout	334 52 13.9	154 56 52.4	4.3135926

PENN, ONEIDA COUNTY, N. Y.

A United States Coast and Geodetic Survey point on a bare hill in Steuben township about 2 miles west of Steuben station.

Station mark: A granite post marked $\frac{U \mid S}{S \mid C}$ with four granite witness posts.

Latitude, 43° 22′ 46.56″. Longitude, 75° 15′ 36.36″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Gum	148 54 29.0	328 45 13.0	4.5407023
Boonville	155 21 42.2	335 19 05.8	4.0885049
Schwartz	170 16 34.5	350 13 54.7	4.4883160
Myers	229 47 55.8	49 54 30.9	4.2281188
West Canada	249 30 13.7	69 52 17.9	4.6642805
Fort Noble	264 17 01.0	84 34 59.0	4.5500200
Hamilton	266 52 46.9	87 29 36.5	4.3601480
West Creek	280 50 11.0	101 13 37.0	4.6719400
Schuyler	334 10 19.3	154 16 17.0	4.4284693

PERSONS, DELAWARE COUNTY, N. Y.

(Not occupied.)

On a round bare knoll in Franklin township, on land owned by A. R. Persons (Treadwell post-office).

Station mark: A bronze tablet cemented in solid rock 15 inches below surface of ground and covered with a small pile of flat stones.

Latitude, 42° 22′ 22.15″. Longitude, 75° 03′ 10.37″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Butternut	124 07 36.1	304 00 03.0	4.2681221
Meredith	254 10 13.3	74 16 12.3	4.1022924
Bramley	293 21 14.0	113 30 42.9	4.3237562

PLAINFIELD, OTSEGO COUNTY, N. Y.

On a bald ridge owned by J. J. Roberts in town of Plainfield, 1½ miles south of Plainfield Center. Some timber still standing on western end of ridge.

Station mark: A blue stone post 36 by 6 by 6 inches set 22 inches in the ground and resting on solid rock. In the center of top of post is cemented a bronze triangulation tablet.

Latitude, 42° 48′ 40.79″. Longitude, 75° 11′ 14.665″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log dist. meters.
Tassell	143 51 27.3	323 46 10.4	4.2580080
Litchfield	190 01 40.3	10 03 22.7	4.2918608

RICE, FRANKLIN COUNTY, N. Y.

(Not occupied.)

On a partly cleared mountain about 3 miles east of Madawaska station, on the New York and Ottawa Railway. Can go in rowboat from station to foot of mountain.

Station mark: A bronze triangulation tablet cemented in solid rock.

Latitude, 44° 30′ 44.56″. Longitude, 74° 20′ 55.82″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log dist. meters.
Azure	104 50 29.	284 44 03.	4.09800
Debar	225 01 52.	45 07 15.	4.15666
St. Regis	322 36 47.	172 37 34.	4.06515

ROCK, LEWIS COUNTY, N. Y.

A high rocky point in Watson township, 8 miles east of Lowville, on land owned by George Venatti.

Station mark: A bronze triangulation tablet cemented in solid rock.

Latitude, 43° 46′ 58.98″. Longitude, 75° 21′ 49.26″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log dist. meters.
Gum	32 23 03.2	212 18 07.9	4.2524113
Elmer	106 24 11.0	286 14 32.9	4.2890136
Croghan	169 37 16.7	349 36 07.9	4.0906550
Alder	232 09 09.7	52 18 27.6	4.3572002
Stillwater	251 37 58.6	71 51 40.6	4.4461049
Schwartz	347 42 08.2	167 43 45.6	4.1709796

ROCKRIFT, DELAWARE COUNTY, N. Y.

(Not occupied.)

On a high timbered ridge in Walton township.

Station mark: Hemlock signal tree 2 feet in diameter with two notches cut on north and south face and a mound of stone 6 feet in diameter and 3 feet high piled around it.

Reference marks: Azimuth 35°, distance 41.93 feet to a 6-inch spike driven in center of blaze on maple tree. Azimuth 117°, distance 28.34 feet to a 6-inch spike driven in center of blaze on beech tree 10 inches diameter. Azimuth 205°, distance 46.23 feet to a 6-inch spike driven in center of blaze on rock oak tree 16 inches diameter.

Latitude, 42° 06′ 14.29″. Longitude, 75° 13′ 37.48″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Willis	133 10 53.3	313 05 30.6	4.1799136
Loomis	189 15 12.3	9 16 17.1	4.1334963
Starkweather	259 40 09.7	79 47 14.9	4.1704091

SAMS POINT, ULSTER COUNTY, N. Y.

In Warwarsing township, 6 miles from Ellenville, on the southern end of a rocky ridge locally known as Sams Point, and owned by Le Grand Batsford, who lives under the bluff, 400 yards south of station.

Station mark: A bronze triangulation tablet cemented in a large flat rock.

Reference marks: Azimuth 1°, distance 38.43 feet to arrow cut in flat rock. Azimuth 297°, distance 51.97 feet to arrow cut in flat rock. Azimuth 190°, distance 14.22 feet to arrow cut in flat rock.

Latitude, 41° 40′ 15.46″. Longitude, 74° 21′ 25.02″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Houston	0 39 23.5	180 39 16.9	4.3051821
High Point	33 19 35.9	213 07 28.5	4.6672128
Vernon	36 58 17.9	216 51 59.9	4.3415805
Roads	56 10 16.9	235 59 37.5	4.4292886
Wolf	66 48 34.2	246 39 29.6	4.3149145
Monticello	87 17 09.0	267 04 09.7	4.4338327
Walnut	110 49 25.5	290 32 56.2	4.5648950
South Hill	142 43 36.1	322 37 17.4	4.3358465
Denman	149 31 57.0	329 24 36.5	4.4778895
Graham	158 42 30.5	338 34 47.4	4.6430438
Slide	176 10 36.6	356 09 27.3	4.5627439
Sterling	347 38 20.8	167 43 03.4	4.6666435

SCHWARTZ, LEWIS COUNTY, N. Y.

On high ground one-half mile east of Schwartz school house in Greig township.

Theodolite elevated 50 feet.

Station mark: A granite post in top of which is cemented a copper bolt.

Latitude, 43° 39′ 09.63″. Longitude, 75° 19′ 28.37″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Gum	87 15 20.8	267 08 48.6	4.1055027
Elmer	132 30 13.8	312 18 58.8	4.4710612
Rock	167 43 45.6	347 42 08.2	4.1709796
Alder	207 32 12.2	27 39 52.0	4.5061884
Stillwater	225 06 29.5	45 18 33.0	4.5182215
Myers	316 57 29.4	137 06 45.4	4.4242541
Penn	350 13 54.7	170 16 34.5	4.4883160

SEWARD, FRANKLIN COUNTY, N. Y.

In the southeastern part of Franklin county on a high mountain, 3 miles south of Ampersand pond. It is covered with a dense growth of small balsam, but summit has been partly cleared. Best reached from cabin of Santa Clara Lumber Co. on Ampersand pond. Follow up Ward brook on lumber and logging road. Pass first lefthand road, then keep to left to end of road, whence a blazed trail may be followed to summit.

Station mark: A copper bolt set in solid rock 2 feet below surface of ground.

Latitude, 44° 09′ 35.25″. Longitude, 74° 12′ 00.22″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Blue	26 54 00.0	206 45 36.3	4.5535558
Morris	90 05 24.8	269 53 53.6	4.3437268
St. Regis	159 28 26.7	339 22 59.9	4.4701091
Ampersand	178 17 56.0	358 17 48.0	3.9201400
McKenzie	214 13 28.0	34 20 28.0	4.3755900
Moose Peak	216 18 37.6	36 26 49.6	4.4210862
McIntyre	275 56 56.0	96 05 50.0	4.2336600
Marcy	283 12 28.2	103 23 59.8	4.3557847
Vanderwhacker	344 00 06.0	164 04 25.4	4.4808631

SHERBURNE, CHENANGO COUNTY, N. Y.

On a long, bare hill, owned by Nicholas Richards, in the extreme southeastern corner of the town of Sherburne.

Station mark: A bowlder, 24 by 10 by 10 inches, sunk 24 inches in the ground.

Latitude, 42° 38′ 03.405″. Longitude, 75° 25′ 48.51″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Whitcomb	17 03 37.4	197 00 17.2	4.3629384
Berry	66 23 09.5	246 12 35.3	4.3680101
Smyrna	109 43 51.3	289 34 43.9	4.2907616
Telford	249 10 52.8	69 22 27.2	4.3969063
Butternut	319 55 51.7	140 03 35.8	4.3866556

SLIDE, ULSTER COUNTY, N. Y.

On the highest peak in the Catskill Mountains, 5 miles south of Slide Mountain post-office, or J. W. Dutcher's house.

The nearest railroad station is Big Indian on the Ulster and Delaware Railroad.

The top of the mountain is wooded. Theodolite set under center of a tower 25 feet high, and lines of sight cut toward other stations.

Station mark: A copper bolt stamped U. S. G. S. set in a conglomerate rock a little above surface.

Reference marks: Azimuth 38°, distance 27.07 feet to a 6-inch spike driven in a balsam tree, 12 inches in diameter, 2½ feet above ground. Azimuth 244°, distance 32.65 feet to arrow cut in ledge in path around north side of tower. Azimuth 289°, distance 220.65 feet to arrow cut in ledge of rock, east outlook from mountain.

Latitude, 41° 59′ 57.11″. Longitude, 74° 23′ 10.87″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Walnut	53 42 07.4	233 26 44.2	4.5971647
Graham	108 23 15.3	288 16 41.6	4.1539652
Andes	130 32 52.6	310 18 47.4	4.5803074
Utsayantha	159 19 04.0	339 10 51.4	4.6765330
Sams Point	356 09 27.3	176 10 36.6	4.5627499
South Hill	29 03 59.8	208 58 49.8	4.3421254

SMYRNA, CHENANGO COUNTY, N. Y.

On the highest point of a bare hill in the town of Smyrna 4 miles west of the village.

Station mark: A bluestone post, 48 by 6 by 6 inches, set 30 inches in the ground (resting on solid rock) in the center of top of which is cemented a bronze triangulation tablet.

Latitude, 42° 41′ 36.32″. Longitude, 75° 39′ 16.21″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Berry	10 29 21.3	190 27 53.7	4.2100681
Sherburne	289 34 43.9	109 43 51.3	4.2907616

SOUTH HILL, ULSTER COUNTY, N. Y.

(Not occupied.)

In Warwarsing township, on a sharp, round, partially cleared hill, 2 miles north of Ulster Heights post-office, on land owned by Grant Sheely, who lives 500 yards south of station.

Station mark: The rock oak signal tree.

Reference marks: Azimuth 9°, distance 45 feet to arrow cut in bowlder 6 by 5 by 3 feet exposed. Azimuth 201°, distance 60 feet to arrow cut in bowlder 4 by 3 by 2 feet exposed. Azimuth 245°, distance 70 feet to arrow cut in bowlder 6 by 2 by 1 feet exposed.

Latitude, 41° 49′ 34.00″. Longitude, 74° 30′ 53.68″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Walnut	78 42 43.0	258 32 31.2	4.3346119
Denman	166 10 19.4	346 09 17.6	3.9500513
Slide	208 58 49.8	29 03 59.8	4.3421254
Sams Point	322 37 17.4	142 43 36.1	4.3358465

STARKWEATHER, DELAWARE COUNTY, N. Y.

On a partially cleared ridge in Walton township, 6 miles southeast of Walton, on land owned by J. H. Starkweather, who lives one-half mile east of station.

Station mark: A bronze tablet cemented in bowlder 4 by 3 by 2 feet.

Reference marks: Azimuth 50°, distance 113.10 feet to arrow cut in ledge. Azimuth 110°, distance 75.17 feet to arrow cut in ledge. Azimuth 185°, distance 31.15 feet to arrow cut in ledge.

Latitude, 42° 07′ 39.85″. Longitude, 75° 03′ 03.35″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Rockrift	79 47 14.9	259 40 09.7	4.1704092
Loomis	131 36 04.7	311 30 03.7	4.2172014
Meredith	201 23 26.9	21 29 20.3	4.5177814
Bramley	225 28 50.9	45 38 13.7	4.4299297
Deyoe	294 35 52.3	114 46 08.0	4.3661821

STERLING, ORANGE COUNTY, N. Y.

Near the west side of a brushy ridge in Tuxedo township, S. 67° W. 1½ miles from the southwest extremity of Lake Mombasha, on land owned by the Sterling Park Co.

Station mark: A copper bolt 1 inch in diameter wedged in bowlder and three-quarters inch above surface, and stamped "U. S. G. S." Bowlder 2 by 3 feet by 6 inches above ground.

Reference marks: Azimuth 30°, distance 8.04 feet to arrow cut near north end of bowlder 3 by 4 feet by 4 inches above ground. Azimuth 70°, distance 13.70 feet to arrow cut in bowlder 6 by 4 by 1 foot above ground. Azimuth 287°, distance 5.51 feet to arrow cut in bowlder 5 by 3 by 1 foot above ground. Azimuth 148°, distance 29.01 feet to signal tree.

Latitude, 41° 15′ 45.64″. Longitude, 74° 14′ 18.21″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Bearfort	43 35 48.2	223 29 43.8	4.2720153
High Point	100 28 18.1	280 11 32.0	4.5570329
Eve	106 22 40.1	286 15 41.1	4.1875280
Houston	158 03 52.5	337 59 03.7	4.4333572
Sams Point	167 43 03.4	347 38 20.8	4.6666435
High Torne	332 54 23.9	152 57 22.4	4.1420525

STILLWATER, HERKIMER COUNTY, N. Y.

On Stillwater mountain, about 11 miles west of Beaver station, on Mohawk and Malone Railway, and 2 miles southwest of the stillwater in Beaver river.

Station mark: A bronze triangulation tablet cemented in solid rock.

Latitude, 43° 51′ 42.44″. Longitude, 75° 02′ 02.20″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Schwartz	45 18 33.0	225 06 29.5	4.5182215
Gum	56 42 33.8	236 23 57.4	4.6363342
Rock	71 51 40.6	169 37 16.7	4.4451049
Alder	121 24 06.2	301 19 41.7	3.9989646
Morris	233 19 38.8	53 42 55.4	4.7457777
West	270 19 42.3	90 33 18.8	4.4201784

ST. REGIS, FRANKLIN COUNTY, N. Y.

On a bare, rocky mountain, about 5 miles west of Lake Clear Junction, on Mohawk and Malone Railway. Can be reached in about three hours from Lake Clear Junction by driving to Upper St. Regis Lake, thence taking boat to head of lake, a short carry to Spectacle Pond, thence across the pond, thence a good trail to summit.

Station mark: An aluminum bolt set in solid rock and marked "N. Y. S. Land Survey V. Colvin Supt. No. 300."

Latitude, 44° 24′ 31.27″. Longitude, 74° 19′ 48.323″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Morris	22 50 21.0	202 44 15.1	4.4771258
Hayes	24 02 35.0	203 57 51.0	4.3452200
Azure	137 17 13.9	317 10 02.2	4.3022069
Rice	172 37 34.0	352 36 47.0	4.0651500
Debar	201 47 37.7	21 52 12.9	4.3678052
Lookout	230 07 12.4	50 18 59.7	4.4626659
Moose Peak	283 47 08.7	104 00 49.1	4.4273682
McKenzie	288 37 11.0	108 49 40.0	4.3985600
Ampersand	332 19 16.0	152 24 35.0	4.3390300
Seward	339 22 59.9	159 28 26.7	4.4704091

TASSEL HILL, ONEIDA COUNTY, N. Y.

A station of the United States Coast and Geodetic Survey and of the New York State Survey, in Marshall township, 5 miles east of Waterville.

Station mark: A granite post 48 by 6 by 6 inches, set 44 inches in the ground, and marked "N. Y. S. S. 29."

Latitude, 42° 56′ 29.13″. Longitude, 75° 19′ 00.48″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Schuyler	213 34 46.8	33 42 59.6	4.4692854
Litchfield	250 52 03.1	70 59 08.1	4.1696697
Plainfield	323 46 10.4	143 51 27.3	4.2530080

TELFORD, OTSEGO COUNTY, N. Y.

On a knob, cleared on south end but heavily timbered on north end, in Burlington township, 6 miles east of Edmeston and 10 miles west of Cooperstown. The land is owned by S. W. Telford.

Station mark: A copper bolt set in solid rock, 1 foot below surface of ground, above which is a red sandstone block 15 by 11 by 11 inches in center of top of which is cemented a bronze triangulation tablet.

Latitude, 42° 42′ 49.40″. Longitude, 75° 08′ 44.06″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Butternut	15 42 04.0	195 38 15.2	4.4555214
Sherburne	69 22 27.2	249 10 52.8	4.3969068
Otsego	258 01 19.8	78 19 18.7	4.5674238
Wart	274 03 25.5	94 08 39.9	4.0242858
Hooker	299 39 21.7	119 50 46.5	4.4234765
Utsayantha	307 16 39.4	127 39 12.0	4.7595348
Meredith	330 03 56.9	150 13 42.7	4.5987214

UTSAYANTHA, DELAWARE COUNTY, N. Y.

A station of the New York State Survey 1 mile (air line) southeast of Stamford.

Theodolite elevated 60 feet in an observatory 49.3 feet distant from station. True azimuth from station 197° 25′.

Station mark: A copper bolt, set in solid rock, 18 inches below surface of ground, above which is a granite post 18 by 6 by 6 inches marked "N. Y. S. S. 27".

Latitude, 42° 23′ 56.21″. Longitude, 74° 35′ 24.12″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Andes	31 31 09.9	211 25 15.0	4.3641901
Bramley	59 06 48.4	238 57 34.9	4.3410478
Meredith	91 17 51.2	271 05 06.7	4.4133399
Hooker	134 05 00.6	313 53 52.2	4.4969308
Otsego	167 37 46.6	347 33 08.8	4.6390267
Slide	339 10 51.4	159 19 04.0	4.6765330
Graham	355 13 10.9	175 14 48.4	4.6026806
Telford	127 39 12.0	307 16 39.4	4.7595348

VERNON, SULLIVAN COUNTY, N. Y.

On a timbered ridge in Mamakating township, 2 miles west of New Vernon post-office.

Theodolite elevated 16 feet on stump of pine tree.

Station mark: Stump of pine tree.

Reference marks: Azimuth 247°, distance 55.95 feet to arrow cut in bowlder, 3 by 3 by 3 feet. Azimuth 152°, distance 17.88 feet to signal tree. Azimuth 144°, distance 41.18 feet to a cross (×) cut on east face of bowlder on edge, 6 by 4 by 2 feet above ground. Azimuth 122°, distance 54.30 feet to arrow cut in south end of bowlder 4 by 5 by 3 feet.

Latitude, 41° 30′ 46.44″. Longitude, 74° 30′ 54.49″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
High Point	29 58 07.8	209 52 18.3	4.3909515
Writer	31 51 46.7	211 49 25.0	3.9735791
Roads	105 42 44.9	285 38 24.0	3.9765996
Wolf	148 21 23.3	328 18 37.4	4.0430398
Sams Point	216 51 59.9	36 58 17.9	4.3415805
Houston	281 25 54.3	101 32 05.0	4.1219453
Eve	340 17 30.0	160 21 29.5	4.3964954

VIRGIL, CORTLAND COUNTY, N. Y.

A station of the New York State Survey in Virgil township.

Station mark: A granite post 48 by 6 by 6 inches set 42 inches in the ground marked "N. Y. S. S. 402."

Latitude, 42° 29′ 34.07″. Longitude, 76° 08′ 24.96″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Solon	219 59 02.5	40 06 17.6	4.2937235
Berry	260 07 19.8	80 25 34.2	4.5740224
Bobell	302 34 53.6	122 53 27.9	4.6527993
Maine	336 12 44.6	156 19 15.5	4.5188599
Warren	3 16 28.7	183 14 55.3	4.7478659

WALNUT, SULLIVAN COUNTY, N. Y.

In Liberty township, 1¼ miles southwest of Liberty and 500 feet north of the Walnut Mountain House, on the highest point of Walnut Mountain. A good view can be had in all directions.

Theodolite elevated 36 feet.

Station mark: A bronze triangulation tablet cemented in solid rock level with surface.

Reference marks: Azimuth 326°, distance 130.05 feet to arrow cut in ledge, east edge of ridge. Azimuth 74°, distance 71.42 feet to arrow cut in ledge, west edge of ridge.

Latitude, 41° 47′ 15.90″. Longitude, 74° 46′ 11.34″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
White Lake	23 31 16.3	203 28 34.7	4.1481635
Knack	92 17 00.9	272 08 34.4	4.2445692
Maulik	125 49 19.9	305 41 52.5	4.2803796
Deyoe	175 37 19.6	355 36 17.2	4.4493156
Graham	213 03 57.9	33 12 47.2	4.5237748
Slide	233 26 44.2	53 42 07.4	4.5971647
Denman	235 46 10.1	55 55 20.6	4.3618317
South Hill	258 32 31.2	78 42 43.0	4.3346119
Sams Point	290 32 56.2	110 49 25.5	4.5648950
Wolf	323 49 05.3	143 56 28.8	4.4175630
High Point	350 06 48.2	170 11 05.9	4.7211823

WART, OTSEGO COUNTY, N. Y.

On a bare knoll of cultivated land owned by T. T. Thompson, 5 miles west of Cooperstown in Otsego township. The station is in the southeast corner of field about 8 feet from the fence.

Station mark: A stone post 36 by 6 by 6 inches, set 28 inches in the ground in the center of top of which is cemented a bronze triangulation tablet.

Latitude, 42° 42′ 24.89″. Longitude, 75° 01′ 00.54″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Telford	94 08 39.9	274 03 25.5	4.0242858
Otsego	251 52 56.0	72 05 40.2	4.4302101
Hooker	314 48 24.9	134 54 35.7	4.2450464

WEBB, HERKIMER COUNTY, N. Y.

On high timbered mountain 3 miles southwest of Gull Lake and 1 mile east of Long Lake on land owned by H. Seward Webb.

Can be reached by going to Partlow Junction on Mohawk and Malone railroad, thence by private railroad to Webb's saw mill (Otterkirks mill), thence by trail to Gull Lake, thence by trail (Gull Lake and Long Pond trail) to west boundary of Webb's reserve, thence south along line to summit of ridge (one-half mile) thence east about 700 feet to signal.

Theodolite elevated 30 feet.

Station mark: High stump of tree which was used as support for theodolite.

Latitude, 43° 59′ 46.77″. Longitude, 74° 54′ 11.84″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Morris	241 55 11.4	62 13 02.3	4.5885043
West	313 45 37.6	133 53 48.4	4.3400136

West Mountain, Hamilton County, N. Y.

A dome topped mountain in the town of Long Lake on the west side of Raquette Lake. Summit entirely cleared. Is best reached from Antlers Hotel, Raquette Lake, by small boat to trail near house of Mr. Blanchard on north side of Sucker-brook Bay, thence 4 miles to top of mountain. Water within one-half mile of top.

Station mark: A copper bolt cemented in rock on highest point. Station No. 494.

Latitude, 43° 51′ 35.87″. Longitude, 74° 42′ 24.31″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Stillwater	90 33 18.8	270 19 42.3	4.4201784
Webb	133 53 48.4	313 45 37.6	4.3400136
Morris	209 00 30.7	29 10 08.7	4.5811562
Kempshall	238 41 35.4	58 57 16.0	4.5481265
Blue	266 38 52.0	86 51 33.8	4.3906718

Whitcomb, Chenango County, N. Y.

On the south end of a hill in the town of Guilford and on the west side of North Pond.

Station mark: A cut blue stone post 48 by 6 by 6 inches, set 36 inches in the ground, in the center of top of which is cemented a bronze triangulation tablet, marked "New York 518."

Latitude, 42° 26′ 08.71″. Longitude, 75° 30′ 44.55″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Bobell	37 45 58.1	217 39 09.0	4.3564016
Berry	130 56 19.9	310 49 06.8	4.2959704
Sherburne	197 00 17.2	17 03 37.4	4.3629334
Butternut	261 18 39.1	81 29 42.1	4.3560978
Willis	334 41 21.3	154 47 29.0	4.4669983

WHITE LAKE, SULLIVAN COUNTY, N. Y.

(Not occupied.)

In Bethel township on a timbered ridge at south end of White Lake, on land owned by N. Goldsmith, who lives 300 yards southeast of station. A wooden tower in field about 300 yards west of station gives a good view from N. 20° E. around by west to south.

Station mark: Center of hemlock tree 14 inches in diameter 3 feet above ground, having a mound of stones 5 feet in diameter and 3 feet high piled about it.

Reference marks: Azimuth 23°, distance 279.60 feet to arrow cut in north end of large bowlder, the only large bowlder on hill. Azimuth 157°, distance 82.75 feet to arrow cut in bowlder 16 by 3 by 2 feet exposed.

Latitude, 41° 40′ 17.80″. Longitude, 74° 50′ 14.00″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Knack	138 40 50.0	318 35 05.6	4.2574751
Maulik	157 41 23.4	337 36 38.2	4.4149285
Walnut	203 28 34.7	23 31 16.3	4.1481635

WILLIS, DELAWARE COUNTY, N. Y.

On the summit of a bare flat ridge in the town of Masonville 3 miles south of the village.

Station mark: A marble post 16 by 7 by 7 inches set 24 inches in the ground, in the center of top of which is cemented a bronze triangulation tablet, which is 8 inches below the surface of the ground.

Latitude, 42° 11′ 49.65″. Longitude, 75° 21′ 38.42″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Bobell	107 59 21.4	287 46 26.2	4.4438558
Whitcomb	154 47 29.0	334 41 21.3	4.4669983
Butternut	198 25 48.0	18 30 41.8	4.4986447
Meredith	238 25 28.4	58 43 52.5	4.6437972
Loomis	256 14 30.8	76 20 58.7	4.1345778
Andes	266 48 12.8	87 13 22.4	4.7127779
Rockrift	313 05 30.6	133 10 53.3	4.1799136

WINDSOR, BROOME COUNTY, N. Y.

A station of the New York State Survey situated on the highest part of a timbered hill one-half mile north and 1 mile east of West Windsor.

Station mark: A broken granite post of the N. Y. S. S.

Latitude, 42° 06′ 10.26″. Longitude, 75° 44′ 47.29″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
Ely	97 31 41.6	277 24 41.3	4.1620909
Maine	124 22 43.3	304 13 21.2	4.3638694
Virgil	143 16 17.9	323 00 23.8	4.7334863
Bobell	195 50 55.6	15 53 33.8	4.2956850

WOLF, SULLIVAN COUNTY, N. Y.

In Thompson township on a timbered ridge 1 mile northwest of Wolf Pond, on land owned by the Sullivan County Club. A good view can be had in all directions.

Theodolite elevated 18½ feet on stump of tree.

Station marks: A pine tree 12 inches in diameter, 3 feet above ground, having a pile of stone 6 feet in diameter and 3 feet high piled above it.

Reference marks: Azimuth 235°, distance 43.82 feet to arrow cut in ledge a very little above surface, 3 by 2 feet, exposed. Azimuth 341°, distance 13.75 feet to arrow cut in bowlder 4 by 3 by 2 feet.

Latitude, 41° 35′ 51.07″. Longitude, 74° 35′ 04.62″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
High Point	11 53 48.5	191 50 44.3	4.4963098
Roads	25 55 18.2	205 53 43.1	3.8809053
Monticello	129 54 19.4	309 50 25.2	4.0268466
Walnut	143 56 28.8	323 49 06.3	4.4175630
Sams Point	246 39 29.6	66 48 34.2	4.3149145
Vernon	328 18 37.4	148 21 23.3	4.0430398
Writer	357 14 10.5	177 14 34.5	4.2408390

WRITER, ORANGE COUNTY, N. Y.

On a brushy ridge in Mt. Hope township, 3 miles southwest of Otisville, a station on the Erie railway, on land owned by Mr. Writer, proprietor of the Writer House, Otisville. Renter lives 400 yards east of station. The ridge is cleared on east side giving a good view in all directions.

Station marks: A copper bolt 1 inch in diameter stamped U. S. G. S. set in solid rock.

Reference marks: Azimuth 148°, distance 29.90 feet to an inch hole drilled 1 inch deep in ledge. Azimuth 16°, distance 30.31 feet to an inch hole drilled 1 inch deep in ledge. Azimuth 230°, distance 44.80 feet to an inch hole drilled 1 inch deep in ledge, south end.

Latitude, 41° 26′ 27.34″. Longitude, 74° 34′ 28.46″.

To station.	Azimuth. ° ′ ″	Back azimuth. ° ′ ″	Log. dist. meters.
High Point	28 45 25.1	208 41 57.3	4.1818277
Roads	158 28 59.5	338 27 00.6	4.0548316
Wolf	177 14 34.5	357 14 10.5	4.2408390
Vernon	211 49 25.0	31 51 46.7	3.9735791
Houston	253 18 36.1	73 27 08.3	4.2725795
Eve	319 07 01.4	139 13 21.5	4.3105577

PRIMARY TRAVERSE.

Geographic positions along Ogdensburg and Lake Champlain Railway from Ogdensburg to Churubusco.

Station.	Latitude. ° ′ ″	Longitude. ° ′ ″
Ogdensburg, light house at (U. S. Lake Survey)	44 41 52.3	75 30 14.0
Milepost 114, road crossing 1,000 feet east of	44 42 52.4	75 25 06.0
Milepost 111, road crossing 425 feet west of	44 43 22.6	75 21 51.0
Lisbon station	44 43 38.4	75 19 09.6
Milepost 107, road crossing 205 feet east of	44 43 34.0	75 16 27.4
Milepost 105, road crossing 1,555 feet east of	44 43 41.7	75 14 06.3
Milepost 102, road crossing 250 feet west of	44 43 58.3	75 10 50.6
Madrid station, road crossing 285 feet west of	44 44 10.0	75 08 52.1
Trout Brook, road crossing 1,225 feet west of	44 44 07.4	75 06 18.5
Milepost 96, road crossing 1,540 feet east of	44 44 24.7	75 03 12.2
Norwood station, 4,200 feet west of, copper bolt set in south end of east abutment of bridge over Raquette river, 10½ feet south of center of track	44 44 54.9	75 00 22.2
Norwood station, 2,400 feet west of, copper bolt in ledge of rock in bank 11.8 feet north of center of track and 74.5 feet from milepost 93	44 44 59.5	74 59 58.0
Norwood station, about ¼ mile east of, crossing of O. & L. C. Ry. and R., W. & O. Ry	44 45 08.2	74 59 08.6
Knapp station	44 46 01.2	74 56 10.2
Milepost 87, road crossing 860 feet west of	44 46 49.0	74 53 16.5
Milepost 85, road crossing 2,080 feet east of	44 47 16.4	74 50 12.8
Winthrop and Brasher station, 585 feet east of, west end of bridge over St. Regis river	44 47 39.1	74 47 09.0
Milepost 81, road crossing 2,750 feet east of	44 47 45.8	74 45 12.9
Milepost 79, road crossing 1,120 feet east of	44 47 58.2	74 43 09.8
Milepost 77, road crossing 960 feet east of	44 48 12.7	74 40 46.4
Milepost 75, road crossing 1,965 feet west of	44 48 25.4	74 39 01.7
Milepost 74, road crossing 2,070 feet east of	44 48 50.0	74 36 57.0
Moira station, road crossing 185 feet west of	44 49 31.8	74 33 24.3

Station.	Latitude. ° ′ ″	Longitude. ° ′ ″
Moira station, about 1,130 feet east of, in rocky pasture, about 95 feet south of center of railway track, a bronze triangulation tablet set in rock outcrop about 1 foot above surface of ground, 70.5 feet from corner of pasture	44 49 34.4	74 33 06.2
Moira station, about 2,100 feet east of, in rocky pasture about 79 feet south of center of railway track, a bronze triangulation tablet set in bowlder about 5 by 2 feet 6 inches above ground	44 49 37.1	74 32 53.2
(Tablets 972.65 feet apart.)		
Brushton station, road crossing, 245 feet east of	44 49 49.5	74 30 31.2
Milepost 65, road crossing 110 feet west of	44 50 26.3	74 26 58.6
Bangor station, road crossing 100 feet west of	44 51 05.9	74 24 09.9
Milepost 60, road crossing 620 feet west of	44 51 31.4	74 21 34.8
Milepost 58, overhead road crossing 1,580 feet east of	44 51 39.9	74 18 44.6
Malone station, center of	44 50 58.5	74 17 33.8
Malone Junction, crossing of O. & L. C. Ry. and Mohawk and Malone Ry	44 51 30.4	74 16 30.0
Malone, Franklin co. fair grounds, south meridian monument	44 50 50.4	74 16 38.3
Malone, Franklin co. fair grounds, north meridian monument	44 51 00.2	74 16 38.3
Milepost 53, road crossing 2,230 feet west of	44 52 38.6	74 14 42.9
Milepost 51, road crossing 1,160 feet east of	44 53 55.8	74 12 09.0
Burke station, opposite center of	44 54 10.4	74 10 09.8
Milepost 46, road crossing 1,390 feet east of	44 55 12.4	74 06 21.1
Milepost 44, road crossing 1,920 feet west of	44 55 25.8	74 04 44.8
Milepost 43, road crossing 1,150 feet east of	44 55 44.1	74 02 51.9
Milepost 40, road crossing 890 feet west of	44 56 21.0	73 59 48.7
Milepost 39, road crossing 2,695 feet east of	44 56 57.5	73 57 57.5
Churubusco triangulation station, cross on tower of St. Philominus Catholic Church	44 57 15.6	73 55 55.0

Geographic positions along the Adirondack and St. Lawrence Railway (New York Central), from Malone to the International Boundary Line.

Station.	Latitude. ° ′ ″	Longitude. ° ′ ″
Milepost 63, center of bridge over stream 990 feet north of	44 53 24.4	74 17 08.5
Constable station, road crossing 155 feet north of	44 56 00 3	74 17 04.1
Milepost 58, road crossing 2,070 feet north of	44 57 18.5	74 15 21.8
Milepost 56, road crossing 1,060 feet south of	44 58 30.0	74 14 59.3
Iron boundary post No. 728	44 59 43.4	74 16 02.2

Geographic positions along Mohawk and Malone Railway (New York Central) from Malone south to Owls Head Station.

Station.	Latitude. ° ′ ″	Longitude. ° ′ ″
Milepost 2, road crossing 580 feet south of	44 49 24.4	74 15 29.6
Whippleville flag station	44 48 22.6	74 14 39.9
Milepost No. 6	44 46 27.0	74 13 24.6
Chasm Falls flag station, road crossing 675 feet south of	44 45 37.3	74 12 09.6
Owls Head station, road crossing about ¾ mile north of	44 44 33.2	74 10 32.9
Owls Head triangulation station	44 44 36.8	74 09 35.3

Geographic positions along Rome, Watertown and Ogdensburg Railway from Norwood to Massena Springs.

Station.	Latitude. ° ′ ″	Longitude. ° ′ ″
Milepost 288, road crossing 860 feet south of	44 46 15.8	74 57 23.4
Milepost 290, road crossing 1,640 feet south of	44 47 48.2	74 56 58.0
Plum Brook flag station, road crossing at	44 49 50.8	74 55 19.7
Milepost 294, road crossing 1,540 feet north of	44 51 24.2	74 55 07.5
Milepost 296, road crossing 2,140 feet north of	44 53 06.2	74 54 12.3
Massena Springs station, road crossing 350 feet south of	44 54 53.1	74 53 15.9

Geographic positions along Grand Trunk Railway from Massena Springs to Bombay.

Station.	Latitude. ° ′ ″	Longitude. ° ′ ″
Milepost 94, 330 feet east of center of bridge	44 55 22.9	74 50 44.1
Milepost 92, road crossing 2,480 feet east of	44 55 34.6	74 47 56.0
Milepost 90, road crossing 1,090 feet east of	44 55 38.7	74 45 48.9
Helena station, crossing of New York and Ottawa Railway and Grand Trunk Railway at	44 55 27.1	74 43 01.5
Milepost 85, road crossing 2,045 feet west of	44 55 35.9	74 40 31.5
Milepost 83, road crossing 1,670 feet west of	44 55 44.1	74 38 00.5
Milepost 82, road crossing 245 feet west of	44 55 50.8	74 36 27.9
Bombay station, northwest corner of	44 56 19.2	74 34 19.0
Bombay station, church steeple	44 56 22.7	74 33 56.2

Geographic positions along New York and Ottawa Railway from Helena to Moira.

Station.	Latitude. ° ′ ″	Longitude. ° ′ ″
Ironton flag station, road crossing 380 feet north of	44 53 55.9	74 41 06.8
Milepost 62, road crossing 4,125 feet north of	44 53 14.3	74 39 43.2
Milepost 57, road crossing 370 feet north of	44 51 12.9	74 36 14.5
Milepost 56, road crossing ½ mile south of	44 50 15.0	74 34 56.3

MERIDIAN MARKS.

BINGHAMTON, BROOME COUNTY, N. Y.

Location of station: In courthouse grounds, Binghamton.

Station mark: A granite post 48 by 8 by 8 inches, set 48 inches in the ground, in the center of top of which is cemented a bronze meridian tablet.

Distant mark: North of station 295.5 feet. A granite post 48 by 8 by 8 inches, set 48 inches in the ground, in center of top of which is cemented a bronze triangulation tablet.

HAMILTON, MADISON COUNTY, N. Y.

Location of station: On Hamilton College campus.

Station mark: A marble post 34 by 6 by 6 inches set in a concrete column 48 by 24 by 24 inches. In center of top of post is cemented a bronze meridian tablet.

Distant mark: North of station 665.7 feet. True azimuth 180° 00′ 09″. A marble post 34 by 6 by 6 inches, set in a concrete column 48 by 24 by 24 inches. In center of top of post is cemented a bronze meridian tablet.

Magnetic declination, July 7, 1900, at 7:45 p. m., 9° 10′ west.

GOSHEN, ORANGE COUNTY, N. Y.

Location of station: On the grounds of the Presbyterian Church of Goshen.

Station mark: A blue sandstone post 36 by 8 by 8 inches, set flush with surface of ground, with a bronze meridian tablet in center of top.

Distant mark: A blue sandstone post 36 by 8 by 8 inches, 357.2 feet north of station mark, set flush with surface of ground and in center of top is a bronze meridian tablet.

DELHI, DELAWARE COUNTY, N. Y.

Location of station: On grounds of the Delaware County Agricultural Society at Delhi.

Station mark: A marble post 36 by 8 by 8 inches, set 32 inches in the ground, in center of top of which is cemented a bronze meridian tablet.

Distant mark: 491.3 feet north of station mark, a marble post 26 by 11 by 5 inches, set 23 inches in the ground, and resting on a marble block eight inches thick. In center of top is cemented a bronze meridian tablet.

COOPERSTOWN, OTSEGO COUNTY, N. Y.

Location of station: On the grounds of the Otsego County Courthouse, on west side of main building.

Station mark: A marble post 38 by 8 by 6½ inches, set 34

inches in the ground, and in the center of top is cemented a bronze meridian tablet.

Distant mark: 336 feet north of station mark, a marble post 38 by 8 by 6½ inches, set 34 inches in the ground, and in the center of top is cemented a bronze meridian tablet.

Local referee: E. A. Potter.

MALONE, FRANKLIN COUNTY, N. Y.

Location of station: On the grounds of the Franklin County Agricultural Association.

Station mark: A marble post 36 by 6 by 6 inches, set 30 inches in the ground, in the center of top of which is cemented a bronze meridian tablet. Post is 2 feet north of fence on inside of race track.

Distant mark: North of station mark, 990 feet, a marble post 36 by 6 by 6 inches, set 33 inches in the ground, in the center of top of which is cemented a bronze meridian tablet. Post is 2½ feet south of inside edge of race track and one foot south of railing along inside edge of race track.

Magnetic bearing September 24, 1900, 10 a. m., north 13° 50′ west, by Fauth transit.

NORWICH, CHENANGO COUNTY, N. Y.

Location of station: In city park, eastward from courthouse.

Station mark: A stone post 48 by 12 by 12 inches, top dressed round, 8 inches in diameter, and set 48 inches in the ground; in the center of top is cemented a copper bolt 4 inches long and 1 inch in diameter.

Distant mark: North of station 185 feet, a stone post 48 by 12 by 12 inches, top dressed round to 8 inches in diameter, set 48 inches in the ground, in the center of top of which is leaded a bronze meridian tablet.

UTICA, ONEIDA COUNTY, N. Y.

Location of station: On the Oneida-Herkimer County line and on the city of Utica boundary line (Turner street) at intersection of West Shore track and Bleecker street.

Station mark: A stone post 48 by 10 by 10 inches, dressed with round top, and set 46 inches in the ground. In the center of top is cemented a bronze meridian tablet on which is stamped "N. 34° 07′ 52″ E." true.

Distant mark: North 34° 07′ 52″ east (true) of station one-third mile. A county line monument 48 by 12 by 12 inches, set 36 inches in the ground. On south side of Broad street east of Turner street.

PRIMARY LEVELS.

Hereto is appended a list of elevations derived from the primary levels of last season, that of 1900. Those of the season of 1901 are not ready for publication as they have not yet been reduced to mean sea level; they will be published in the next annual report of this office. In addition to the elevations cited herewith, many other intermediate points had their elevations determined, but those only are printed which correspond to bench marks permanently indicated on the ground by bronze or aluminum tablets.

ERRATA IN PREVIOUS REPORTS.

The following field and clerical errors occur in previous reports of this office:

Corrections to reports of 1899 and 1900 due to the adjustment of the precise level net, which was made by the United States Coast and Geodetic Survey in 1900. (See Coast Survey Report for 1898-99, Appendix No. 8.)

REPORT 1899

	Correction, feet.
Page [illegible] entire list of elevations on precise line from Schenectady to North Creek	−0.136
Page [illegible] entire list of elevations based on Dunkirk	−0.294
Page [illegible] entire list of elevations based on Salamanca	[illegible]

New Bench Mark:

The bronze tablet at schoolhouse No. 4 Maple street, has been removed and a new aluminum tablet set [illegible] feet higher, marked "[illegible] Dunkirk 1899." By Coast Survey adjustment the corrected elevation is	[illegible]
Page [illegible] elevation at Ho[illegible]eads	[illegible]
Elevations in vicinity are affected variably. Readjustment not yet made.)	

	Correction, feet.
Page 93, elevation at Waverly..........	+0.058
(Elevations in vicinity are affected variably. Readjustment not yet made.)	
Page 94, elevation at Cobleskill..........	—0.099
(Elevations south take same correction. Elevations north are affected variably. Readjustment not yet made.)	
Page 96, elevation at Oswego..........	+0.765
(Elevations in vicinity are affected variably. Readjustment not yet made.)	
REPORT 1900.	
Page 180, entire list of elevations on primary line connected with precise line from Schenectady to North Creek..........	—0.126
Page 181, elevation of Greenbush..........	—0.063
Page 185, elevation at Tupper Lake Junction, corrected by precise leveling from deep waterways bench mark at Fort Covington..........	+0.076
(Elevations in vicinity are affected variably. A readjustment of primary net has not yet been made.)	
Page 187, elevations upon Schunemunk and Millbrook quadrangles are readjusted, corrected and republished herewith.	
Page 187, elevation at Poughkeepsie..........	+0.030
Page 189, all elevations based on U. S. Engineer's bench mark "51" at Higginsville..........	+0.488
Page 190, all elevations between Oswego and Dunkirk not yet readjusted, but will take varying correction between that at Oswego, which is....	+0.765
and that at Painted Post, which is..........	+0.104
Page 193, all elevations in list between Herkimer and Collinsville take varying correction between that given to Herkimer from Little Falls connection with Coast Survey adjustment..........	+0.241
and that at Collinsville, which is..........	—0.064

FRANKLIN COUNTY, N. Y.

Precise Leveling.

The elevations published in the following list are based on a primary bench mark of the Deep Waterways Commission at Fort Covington, Franklin county, a 2-inch square cut on east abutment of the Grand Trunk Railroad bridge over Salmon River, 1 foot from the south edge and 1 foot from the east edge. The elevation of this is accepted as 166.355 feet above mean sea level. This elevation is derived by lowering that given by the Deep Waterways Commission for this bench mark 1.115 feet, this being the amount by which the elevation of a precise bench mark of that commission at Hogansburg, Franklin county, has been lowered, as published by the United States Coast and Geodetic Survey in its report for 1898-1899, Appendix No. 8, page 543. This bench mark at Hogansburg is the center of a

punch mark on a one-fourth inch brass bolt cemented in the northeast face of the east buttress of the main tower of St. Patrick's Catholic Church, near mark U. S. P., and its elevation is accepted as 178.198 feet above mean sea level.

This precise line being based on Fort Covington and not adjusted for closure error at Tupper Lake Junction, gives a new value for the bench mark at the latter place as here published 0.076 foot greater than the published elevation of same in my last report, page 185. This bench mark is an aluminum tablet set in foundation of water tank of the New York Central Railroad, Adirondack Division, stamped "1555 Albany."

All bench marks are referred to the Gristmill bench mark at Greenbush opposite Albany, the elevation of which is now accepted as 13.577 feet above mean sea level, and are stamped with the letters "ALBANY" in addition to their figures of elevation.

Tupper Lake Junction, via Moira and Bombay to Fort Covington.

	Elevation, feet.
Tupper Lake Junction, New York Central Railroad, Adirondack Division: In foundation to water tank, aluminum tablet marked "1555 ALBANY".......	1,555.[illegible]
Kildare, [illegible] feet north of station. In large bowlder 8 feet east of rail; bronze tablet marked "[illegible] ALBANY 1900"..	1,537.776
Blue Pond, [illegible] miles north of, 1,[illegible] feet north of milepost "T. 18 and O. [illegible]" in large bowlder 10 feet west of track; bronze tablet marked "1551 ALBANY 1900"..	1,551.161
Brandon, 1 mile north of, 0.4 mile north of milepost "T. 25 and O. 105," in large bowlder 10 feet west of track, bronze tablet marked "1535 ALBANY 1900"..	1,534.681
[illegible], 0.5 miles north of, 125 feet north of section post 14-15, and 50 feet east of [illegible] road, in large rock, bronze tablet marked "1556 ALBANY 1900".	1,555.[illegible]
Santa Clara, [illegible] north of, [illegible] feet north of milepost "T. 37 and O. [illegible]." In large rock 50 feet east of railroad, bronze tablet marked "1396 ALBANY 1900"..	1,395.[illegible]
St. Regis Falls, [illegible] feet south of station, in large rock 20 feet west of railroad, [illegible] feet north of [illegible] road water tank, aluminum tablet marked "[illegible] ALBANY 1900"..	1,25[illegible]
[illegible] east side of [illegible] road at culvert No. [illegible] in large rock, aluminum tablet marked "[illegible] ALBANY 1900"...	[illegible]
[illegible] aluminum tablet marked "[illegible] ALBANY 1900"	[illegible]
[illegible] bronze tablet marked "[illegible] ALBANY 1900"	[illegible]
[illegible]	[illegible]
[illegible] bridge over Salmon river [illegible] bronze tablet marked "[illegible] ALBANY 1900"	[illegible]

WASHINGTON AND SARATOGA COUNTIES, N. Y.

Schuylerville Quadrangle.

The elevations published in the following list are based on an aluminum tablet, set in stone of pilaster at left side of the front entrance of the high school building at Fort Edward, N. Y., and marked "145 A." This bench mark was touched upon by the Deep Waterways Commission—under the head of wye and water leveling between the Gristmill bench mark near Albany and permanent bench mark, "P" of their precise line at St. Patrick's Catholic church, Hogansport, via Lake Champlain; and the elevation is derived by the adjustment of this line to the corrected elevations of these bench marks as determined by the latest adjustment of the United States Coast and Geodetic Survey, in 1900, and published in report of that bureau for 1898-99, Appendix No. 8, and is accepted as 144.386 feet above mean sea level. The leveling was originally based upon bench marks established by the Hudson river and Lake Champlain canal, and as a result the markings are generally 1 foot too high.

All bench marks are referred to the Gristmill bench mark near Albany and are stamped with the letter "A" in addition to their figures of elevation.

	Elevation, feet.
Schuylerville, via Burgoyne and Stafford, to Saratoga.	
Schuylerville, corner College and Green streets, school building; under second window from west corner; bronze tablet marked "216 A"	214.991
Saratoga, along Fitchburg and Delaware and Hudson Railroads, via Ganesvoort to Fort Edward.	
Saratoga, 5.5 miles northeast of; south Wilton church; south side near front, in foundation; bronze tablet marked "327 A"	326.016
Ganesvoort, Empire House Hotel; south side near front, in brickwork; bronze tablet marked "246 A"	245.081
Schuylerville, via Bald Mountain, Middlefalls and Easton Corners, to Sarles Ferry.	
Middlefalls; south bank of creek; 75 feet west of covered bridge; southeast corner of brick gristmill; bronze tablet marked "303 A"	302.611
North Easton (Easton Corners), 0.1 mile north of; 10-foot arch culvert; southwest wing; first stone back of arch on level with base; bronze tablet marked "332 A"	331.558
Sarles Ferry, via Quaker Springs, to Stafford.	
Quaker Springs, 600 feet west of crossroads; north side of road in outcrop; bronze tablet marked "321 A"	320.078
Bald Mountain, via Durkeetown, to Fort Edward.	
Durkeetown church, south side; 10 feet from rear corner; in stone foundation; bronze tablet marked "171 A"	169.778
Fort Edward, high-school building; front entrance; in stone pilaster at left side; bronze tablet, marked "145 A"	144.386

SCHOHARIE, ALBANY AND SCHENECTADY COUNTIES, N. Y.

Berne Quadrangle.

The elevations published in the following list are based on a bronze tablet set in the north end of east abutment of bridge at Duanesburg, marked "681 ALBANY 1898." The elevation of this bench mark is derived by precise leveling of the United States Geological Survey, and, as corrected by the latest adjustment of the United States Coast and Goedetic Survey, is accepted as 680.246 feet above mean sea level. (See United States Coast Survey Report for 1898-99, Appendix 8, p. 543.)

All bench marks are referred to the Gristmill bench mark at Greenbush opposite Albany, N. Y., the elevation of which is accepted as 13.577 feet above mean sea level, and are marked with the letters "ALBANY" in addition to their figures of elevation.

Duanesburg, along Delaware and Hudson Railroad, to Delanson.

	Elevation, feet.
Duanesburg, 1,000 feet west of Delaware and Hudson station; on north end of east abutment of bridge; bronze tablet, marked "681 ALBANY 1898"...	680.246
Delanson, via Quaker Street and Gallupville, to West Berne.	
Gallupville, Dutch Church; set in wall near southeast corner; bronze tablet, marked "831 ALBANY"........	830.734
East Berne, via Berne, to West Berne.	
Berne, Lutheran Church; in southeast corner; bronze tablet, marked "1015 ALBANY"	1,014.410
Berne, via South Berne and Westerlo, to East Berne.	
Westerlo, bridge over creek; in top of south end of east abutment; bronze tablet, marked "1144 ALBANY"........	1,143.518
East Berne, west entrance to village; 300 feet east of Berne road intersection; in embedded stone at bend in road; bronze tablet, marked "1174 ALBANY"	1,173.734
East Berne to Altamont.	
Altamont, Altamont Hotel; in foundation wall, southwest side of; bronze tablet, marked "464 ALBANY"........	464.204

SCHOHARIE, DELAWARE, GREENE AND ULSTER COUNTIES, N. Y.

Rhinebeck, Rosendale, Phoenicia and Gilboa Quadrangles.

The elevations published in the following lists are based on and adjusted between two bench marks. One in an aluminum tablet set in the front face of the city hall in Poughkeepsie, N. Y., stamped "173 ALBANY 1899," the elevation of which is

accepted as 172.613 feet above mean sea level, and the other a bronze tablet at the northwest corner of the stone foundation of Union schoolhouse at Cobleskill, N. Y., stamped "930 A," the elevation of which is accepted as 929.002 feet above mean sea level. The elevation of the Poughkeepsie bench mark depends directly upon that of a precise bench mark of the United States Coast and Goedetic Survey at the west abutment of the Poughkeepsie bridge. The Cobleskill bench mark was established by precise levels of this survey, and is taken as corrected by the United States Coast and Goedetic Survey. (See Report for 1898-99, Appendix No. 8, p. 543.)

All bench marks are referred to the Gristmill bench mark near Albany, the elevation of which is accepted as 13.577 feet above mean sea level, and are marked by the letters "ALBANY" in addition to their figures of elevation.

Poughkeepsie Bridge, along West Shore Railroad, to Kingston.	Elevation, feet.
West Park, West Shore Railway station; in north wall at northwest corner; bronze tablet, marked "113 ALBANY"	113.380
Kingston, along Ulster and Delaware Railroad, to Phoenicia.	
Kingston, city hall; in center of face wall of front portico; aluminum tablet, marked "223 ALBANY"	223.206
West Hurley, 0.5 mile east of railroad station; 100 feet northwest of railroad crossing on south side of highway; bronze tablet set in face of rock; marked "546 ALBANY"	545.683
Shokan, 0.2 mile east of station; bridge No. 22, west abutment; north end of; on bed plate; bronze tablet, marked "532 ALBANY"	532.615
Phoenicia, Ulster and Delaware Railroad bridge; south pier; top of east end of; aluminum tablet, marked "804 ALBANY"	804.329
Phoenicia to Shandakin.	
Shandakin, steel bridge at forks of road; top of southwest wing wall of; bronze tablet, marked "ALBANY 1071"	1,070.559
Shandakin, via Big Indian and Oliverea, to Slide Mountain P. O.	
Slide Mountain post office; rock at northwest corner of; bronze tablet, marked "ALBANY 1665"	1,664.228
Shandakin to Lexington.	
Westkill, 1.3 miles south of; top of Deep Notch, west side of road; on bowlder stone; aluminum tablet, marked "ALBANY 1901"	1,900.254
Phoenicia, via Hunter and Lexington, to Prattsville.	
Edgewood, 300 feet north of station; bridge, north pier, east end; in top stone; bronze tablet, marked "1790 ALBANY"	1,789.764
Hunter, public school building; in foundation wall, north side of front entrance; aluminum tablet, marked "1602 ALBANY"	1,601.720
Jewett Center, East Kill bridge; east abutment; north end; top stone; aluminum tablet, marked "1405 ALBANY"	1,404.386
Lexington, Schoharie Creek bridge; north pier, west end, top stone; aluminum tablet, marked "1329 ALBANY"	1,328.918

	Elevation, feet.
Prattsville, public school building; in front wall; aluminum tablet, marked "1164 ALBANY"	1,163.861
Prattsville to Windham.	
Windham; bridge over Batavia creek on road to Hunter; top of north abutment; east end; bronze tablet; marked, "1517 ALBANY"	1,517.117
Prattsville to Gilboa.	
Gilboa, 800 feet north of; on east side of road, opposite bridge over Schoharie creek; in ledge of rock; bronze tablet, marked "1010 ALBANY"	1,009.473
Gilboa to Manorkill.	
Manorkill, white church opposite post office; in southeast corner of; bronze tablet, marked "ALBANY 1515"	1,514.678
Gilboa, via Blenheim, to Breakabeen.	
Blenheim, 300 feet north of post office; northwest side of road, in ledge of rock; aluminum tablet, marked "813 ALBANY"	812.779
Breakabeen, Lutheran church; aluminum tablet, marked "ALBANY 754"	753.723
Franklinton to Livingstonville.	
Livingstonville, Methodist church; in northwest corner of; bronze tablet, marked "ALBANY 1077"	1,076.716

ULSTER AND ORANGE COUNTIES, N. Y.

Newburg Quadrangle.

The elevations published in the following list are based on an aluminum tablet set in the front face of the city hall, in Poughkeepsie, and marked "173 ALBANY 1899." The height of this is derived from a bench mark established in Poughkeepsie by the United States Coast and Geodetic Survey, the elevation of which, as corrected in accordance with their adjustment of 1900, is accepted as 42.956 feet above mean sea level. Dependent on this, the datum tablet of this survey in Poughkeepsie is accepted as being 172.613 feet above mean sea level. The correction, has been applied on account of a gross error of 1 foot in leveling from Poughkeepsie, via Highlands, along West Shore Railroad to Newburgh, less a correction of 0.030 foot, by which the final elevations of the Poughkeepsie bench marks exceed their previously accepted values. The bench marks are therefore marked about 1 foot too high.

All bench marks dependent on this datum are referred to the Gristmill bench mark near Albany, the elevation of which is accepted as 13.577 feet above mean sea level, and are marked with the letters "ALBANY" in addition to their figures of elevation.

Newburg, via Erie Railroad, to Cornwall.	Elevation, feet.
Newburg; tablet set near southwest corner, to the right of entrance to post-office building, marked "ALBANY 95"	94.130
Cornwall, via Newburg Junction, along the Railroad to Oxford.	
Cornwall, 600 feet north of; tablet set in face of west abutment, New York, Ontario and Western Railroad bridge	271.299
Cornwall, via Woodbury and Turners, along Erie Railroad, to Oxford.	
Central Valley; tablet set in large stone in retaining wall, front of Finken's place, first west of Noxon's store; marked "ALBANY 488"	486.919
Arden; tablet set in pier, east end railroad bridge over stream, 300 feet north of station; marked "ALBANY 519"	518.280
Doyle's, ¼ mile east of; tablet set in road face of large bowlder, marked "ALBANY 718"	717.506
Oxford, via Burnside, to Cornwall.	
Greycourt; tablet set in face of north abutment, Lehigh and Hudson River Railway bridge over road; marked "ALBANY 447"	445.854
Burnside, 1¼ miles east of; tablet, east face of road-bridge abutment, marked "ALBANY 357"	356.421
Newburg, Coldenham, Walden, to New Hurley Station.	
Newburg; post-office building; in southwest corner of, to the right of entrance; aluminum tablet, marked "95"	94.130
Coldenham, 0.2 mile west of; at entrance to A. B. Lindsey's place; large stone gatepost; aluminum tablet, marked "ALBANY 434"	434.345
Walden, "National Bank of Walden;" in southeast corner of; aluminum tablet, marked "ALBANY 376"	374.862
New Hurley Station, via Gardiner and New Paltz to Loyd.	
Gardiner station; 150 feet south of, in east wall of culvert; bronze tablet, marked "ALBANY 309"	307.798
New Paltz, New Paltz Savings Bank; in southwest corner; bronze tablet, marked "ALBANY 237"	235.663
Loyd, Centerville Hotel; in southeast corner of; bronze tablet, marked "ALBANY 359"	357.768
Loyd to Clintondale.	
Clintondale, Ambrose's store; in southwest corner of; bronze tablet, marked "ALBANY 553"	552.331

DUTCHESS AND COLUMBIA COUNTIES, N. Y.

Poughkeepsie, Rhinebeck, Millbrook, Dover, Copake, and Kinderhook Quadrangles.

The elevations published in the following list are derived by connection with two lines of precise leveling carried to Greenbush, N. Y., near Albany, from mean sea level at New York and Boston, and adjusted to the corrected mean elevation of the Greenbush "Gristmill" bench mark as determined by the latest adjustment of the United States Coast and Geodetic Survey. Part of this list consists of levels adjusted between Poughkeepsie and Chatham, and the bench marks listed between Poughkeepsie and Millerton, via Clinton Corners and Dover

Plains, are republished, with corrected elevations resulting from this adjustment. The remainder of the list consists of levels adjusted between Niverville and Hudson.

All bench marks are referred to the Gristmill bench mark near Albany, the elevation of which is accepted as 13.577 feet above mean sea level, and are marked by the letters "ALBANY" in addition to their figures of elevation.

	Elevation, feet.
Poughkeepsie.	
Station; brass bolt keyed in fifth stone above ground, second step from east end of column on north side of arch bridge, marked "+"	42.956
City hall; tablet set in front face marked "ALBANY 173"	172.613
Poughkeepsie, via Pleasant Valley and Salt Point, to Clinton Corners.	
Pleasant Valley; tablet set in face of rock, north side of track, 300 feet east of station; marked "ALBANY 211"	211.086
Clinton Corners; tablet set in coping stone, north end, west abutment, bridge over Salt Point Creek; marked "ALBANY 244"	244.395
Clinton Corners, via Washington Hollow and South Millbrook, to Dover Plains.	
Millbrook; aluminum plate on west side of Millbrook Bank, near southwest corner of building; marked "ALBANY 568"	568.484
Dover Plains; tablet set in northwest corner of bank; marked "ALBANY 406"	406.226
Dover Plains, via Wassaic and Amenia, along Harlem Railroad, to Millerton.	
Amenia; aluminum tablet set in corner stone, southwest corner Amenia Bank; marked "ALBANY 573"	573.530
Millerton, via Shekomeko, along Newburgh, Dutchess and Connecticut Railroad to Pine Plains.	
Millerton; aluminum tablet on northeast front of brick block hotel; marked "ALBANY 701"	700.741
Pine Plains; aluminum tablet set in stone foundation of Myer's dwelling, near southeast corner of house; marked "ALBANY 474"	474.286
Pine Plains, via Stissing and Stanfordville, to Clinton Corners.	
McIntyre; aluminum tablet set in face of south abutment; third course from ground; Central New England bridge at; marked "ALBANY 399"	399.048
Millerton, via Boston Corners, Craryville and Philmont, to Chatham.	
Millerton; bronze tablet in brick block hotel; marked "ALBANY 701"	700.741
Boston Corners, 300 feet south of station, in top of southeast corner of culvert on New York Central Railroad; bronze tablet, marked "ALBANY 727"	726.809
Craryville, 500 feet west of station; south side of track, in west abutment of railroad bridge; bronze tablet, marked "ALBANY 635"	634.848
Philmont, Empire House; in the west side of; in stone over cellar window; bronze tablet, marked "ALBANY 525"	525.227
Ghent, ⅛ mile south of; on southwest corner of culvert (stream to west 15 feet below)	390.176
Chatham, east side of tenth roof support from east end of station, train side; being a bench mark of the Massachusetts topographic survey commission; plate marked "471"	470.663
Chatham, about 1 mile north of; on west abutment of bridge 201, top stone, being bench mark No. 84 of the Massachusetts topographical survey commission; marked by a hole and "B. S." bottom of hole	519.206
Niverville; in southwest corner of brick water tank, 3 feet from ground; bronze tablet, marked "ALBANY 323"	322.658

Niverville, via Stuyvesant Falls, to Hudson.	Elevation, feet.
Stuyvesant Falls, bridge over Kinderhook creek, west end of; in end of north wing wall; bronze tablet, stamped "ALBANY 156"	156.057
Hudson station, United States Coast and Geodetic Survey bench mark No. 4, described by them "A. R. R." bench, the usual roundheaded bolt, in west side of top of stone pier under iron column, under overhead bridge in street leading to docks and Athens ferry; the first bridge north of Hudson station. The pier is under the second column from south end in the east row of three	10.398

JEFFERSON AND ST. LAWRENCE COUNTIES, N. Y.

Clayton, Theresa, and Alexandria Bay Quadrangles.

The elevations published in the following list are based upon permanent bench marks established in the course of precise leveling by the Deep Waterways Commission at Clayton, Fishers Landing, Alexandria Bay and Chippewa Village, in the vicinity of Cape Vincent, N. Y. The accepted elevations of these are derived by the latest adjustment of the United States Coast and Geodetic Survey, made in 1900. (See Appendix No. 8, report for 1898-99 of that Bureau.)

All bench marks are referred to the Deep Waterways Commission's bench marks at Cape Vincent, which are published in the Coast Survey report, the elevations there given being accepted, and they are stamped with the letters "CAPE VINCENT" in addition to their figures of elevation. The latter are generally one foot lower than the values stamped upon the bench marks, because of a subsequent adjustment, as explained under "Precise Leveling," page 177.

Clayton, via Clayton Center and Depauville, to Limerick.	Elevation, feet.
Clayton, Catholic church; in water table at southwest corner of; copper bolt.	278.742
Clayton, James street, in front of Mrs. Linnell's residence, on back part of top of fire hydrant; copper bolt, marked "CAPE VINCENT 289"	287.558
Clayton Center, residence of Merritt Lengenfelter; on west face of building at south corner in stone foundation wall; bronze tablet, marked "CAPE VINCENT 423"	422.004
Depauville, at crossroads in; under residence of Ira Gillett, in east corner of of stone foundation wall; aluminum tablet, marked "299 CAPE VINCENT"	297.476
Perch River, stone schoolhouse; in northeast corner of water table; bronze tablet, marked "338 CAPE VINCENT"	336.920
Chaumont, Main street, Hiram Copley's stone office building; in north face of buttress at northwest corner of; aluminum tablet, marked "295 CAPE VINCENT"	293.385
Limerick, via Chaumont, to Three Mile Bay.	
Three Mile Bay, Baptist church; in southeast corner of foundation wall; aluminum tablet, marked "266 CAPE VINCENT"	264.504

	Elevation, feet.
Three Mile Bay, via St. Lawrence, to Clayton.	
St. Lawrence, 225 feet north of crossroads; on east side of road, on large bowlder; bronze tablet, marked "357 CAPE VINCENT"	356.219
Clayton, via Lafargeville, to Theresa.	
Clayton, the Barker (brick) building, on the north side of Water street; in limestone water table on the west side, 1.85 feet northerly from the southwest corner of building, the said corner being 60 feet easterly from the point where the east line of James street, projected, would intersect the north line of Water street; aluminum tablet, marked "257 CAPE VINCENT"	256.175
Lafargeville, Orleans Hotel (stone building); in southeast corner of; aluminum tablet, marked "381 CAPE VINCENT"	380.388
Theresa, stone high school on Main street; on water table in north face and near northwest corner of belfry tower of; aluminum tablet, marked "376 CAPE VINCENT"	375.842
Theresa, via Redwood and Browns Corners, to Alexandria Bay.	
Redwood, "The Dollinger House" (hotel); in east side and near northeast corner of foundation wall of; aluminum tablet, marked "365 CAPE VINCENT"	364.712
Alexandria Bay, Reformed church; 29.9 feet north northeast from the northwest corner of; in ledge in church lot; aluminum tablet, marked "283 CAPE VINCENT"	282.193
Lafargeville, via Omar, to Fishers Landing.	
Omar, 420 feet northerly from intersection of Fishers Landing and Collins Landing roads; in bed rock on sandstone ledge, west side of the Collins Landing road, and on a line with northerly side of the Omar schoolhouse and distant 51.62 feet from the northwest corner of the schoolhouse; bronze tablet, marked "297 CAPE VINCENT"	295.671
Fishers Landing, crossroads near; 72.6 feet from the south corner of Mrs. Tom's residence and 131 feet northwest of the west corner of a house on the opposite side of the road; top of a roundheaded one-fourth-inch brass bolt cemented into bed rock 6 inches below surface of ground. The letters "U. S. P. B. M. 29" are cut in the bed rock. This is a bench mark set by the Deep Waterways Commission	274.277
Redwood, via South Hammond, to Chippewa Village.	
Chippewa Village; stone schoolhouse, District No. 11, 1 foot easterly from the northeast corner of, set in bed rock; bronze tablet marked "289 CAPE VINCENT"	287.690
Chippewa Village; stone schoolhouse, district No. 11, north face of northeast corner; center punch mark of brass bolt; being permanent bench mark C. V. of the Deep Waterways Commission	290.620
Limerick to Dexter.	
Dexter, brick schoolhouse at; 2 feet easterly from northwest corner of main building, in limestone water table on northerly side of; aluminum tablet, marked "326 CAPE VINCENT"	324.365
Limerick, via Brownville, to Watertown.	
Brownville, brick schoolhouse at 5 corners; midway of front face of building and 3.2 feet above surface of ground, in limestone foundation wall; bronze tablet, marked "355 CAPE VINCENT"	354.203
Watertown, Arsenal street; State armory, front face, west end; aluminum tablet, marked "479 CAPE VINCENT"	478.027
Brownville, via Sanford, to Felts Mills.	
Felts Mills, bridge over north branch of Black River at; on east end of south abutment (Island abutment); bronze tablet, marked "583 CAPE VINCENT"	582.361

REPORT

OF THE

DIVISION ENGINEER

OF THE

EASTERN DIVISION

For the Year Ending September 30, 1901.

Trevor McClurg Leutze

By the death of Trevor McClurg Leutzé, which occurred on the 14th day of October, 1901, the State was deprived of the services of an efficient employee.

Born in Dusseldorf, Germany, 1851, Mr. Leutzé came to this country at an early age and took up the work of civil engineering. In 1886 he entered the employ of the Department of the State Engineer and Surveyor, serving as Assistant Engineer from 1887 until April 1, 1899, when he was appointed Division Engineer of the Eastern Division, which position he held at the time of his death. While so employed Mr. Leutzé planned and had charge of the construction of many important works and structures on the State canals; April, 1900, until February, 1901, he was actively engaged as one of the consulting engineers on the survey for a barge canal from the Hudson river to the Great Lakes.

Eastern Division.

ALBANY, N. Y., *October* 1, 1901.

Hon. EDWARD A. BOND, *State Engineer and Surveyor:*

Dear Sir.—I have the honor to submit to you the annual report for the eastern division of your department for the fiscal year ending September 30, 1901.

CANALS AND GENERAL APPROPRIATIONS.

This division embraces about 106 miles of the Erie canal extending from Albany to the east line of Oneida county, near Utica; 66 miles of the Champlain canal, from Watervliet to Whitehall; 12 miles of the Glens Falls feeder, the Port Schuyler and Watervliet sidecuts, the Albany Basin and the pond above the Troy dam, amounting in all to 188.36 miles of navigable water. There are three short unnavigable feeders from the Mohawk River at Rexford Flats, Little Falls and Rocky Rift, and one from the Schoharie Creek at Fort Hunter, amounting in all to 5.13 miles.

There were no breaks of any importance in the canals on this division during the past year, except the breaking of the gates in the feeder from the Mohawk River at Rexford Flats, N. Y., and a few bad leaks in the "sixteens" at Cohoes, N. Y.

EXTRAORDINARY REPAIRS.

TWENTY-THIRD STREET BRIDGE, WATERVLIET, N. Y.

Chapter 440, Laws of 1900.

Owego Bridge Co., contractors.

F. S. Strong, engineer in charge.

Plans approved by Canal Board, October 22, 1900. Contract dated, December 5, 1900. Contract to be completed, April 1,

1901. Work started, December, 1900. Contract completed, May 15, 1901.

Appropriation	$15,000 00
Engineer's estimate (original)	11,736 00
Final estimate	13,530 92

The old Whipple arch bridge at this place was not strong enough to safely carry the loads that might attempt to cross it, and it is replaced with a steel plate girder bridge. The east abutment was cut down to the level of the towpath and a new abutment was built, the face of which was about eleven feet back from the face of the old abutment. This, with a vertical wall and embankment shown on plans, permitted a towpath on this side of the canal under the new bridge to the north side of the upper side-cut lock. A stairway was also included to make the east approach more easy of access to people on the east side of the canal.

BRIDGE OVER CHAMPLAIN CANAL, TOWN OF WATERFORD, N. Y.

Chapter 629, Laws of 1898; chapter 219, Laws of 1899; chapter 443, Laws of 1900.

The plans for this bridge provided for the removal of the old fixed bridge No. 3, over the Champlain canal, near Burton's saw mill, which was unsafe and had approaches with very steep grades, and for building a new swing bridge about 75 feet south of the old bridge, having approaches with easy grades. The pivot pier was made of concrete and carried down to rock foundation, about 14 feet below canal bottom. The concrete abutments at each end were supported on piles driven to rock.

A contract was entered into on November 15, 1900, with the Owego Bridge Company for the construction of this bridge at a contract price of $10,150.

The substructural work was practically completed in March, 1901, but the contractor did not start erecting the superstructure until August 21, 1901, and it is not entirely completed at this date. However, the bridge will be open for traffic inside of two

weeks, and will be a great and much needed improvement for the people who have occasion to cross the Champlain canal at this point. The substructural work on this bridge was under the charge of Mr. F. N. Sanders.

BRIDGE OVER ERIE CANAL, TOWN OF MINDEN, N. Y.

Chapter 596, Laws of 1899; chapter 457, Laws of 1900.

Owego Bridge Co., contractors.

M. H. Ranney, engineer in charge.

Plans approved by Canal Board, August 16, 1900. Contract dated, October 11, 1900. Contract to be completed, April 1, 1901. Work started, December, 1900. Contract completed, May 15, 1901.

Appropriation	$8,500 00
Engineer's estimate (original)	7,267 55
Final estimate	7,254 67

The old superstructure was in an unsafe condition, and had to be renewed. When the plans for the new bridge were prepared it was decided to change the alignment of the new bridge so that it would be nearly on line with the new highway bridge across the Mohawk River. This made it necessary to change the berme abutment and to rebuild the towpath abutment.

VERTICAL WALL ON GLENS FALLS FEEDER, NEAR POWER HOUSE OF ELECTRIC STREET RAILWAY, WARREN COUNTY, N. Y.

Chapter 438, Laws of 1900.

W. A. Burnham, contractor.

W. J. Gilmour, engineer in charge.

Plans aproved by Canal Board, September 17, 1900. Contract dated, October 29, 1900. Contract to be completed, opening of navigation, 1901. Work started, December, 1900. Contract completed, May, 1901.

Appropriation	$10,000 00
Engineer's estimate (original)	8,455 00
Final estimate	7,578 05

REBUILDING SEARLES WASTE-WEIR NO. 9, ON THE CHAMPLAIN CANAL.

Chapter 311, Laws of 1900.

Higley & Barber, contractors.

Ralph Russell, engineer in charge.

Plans approved by Canal Board, November 13, 1900. Contract dated, December 26, 1900. Contract to be completed, April 15, 1901. Work started, December, 1900. Contract completed, April, 1901.

Engineer's estimate (original)	$9,081 40
Final estimate	10,934 84

About October 1, 1900, the Superintendent of Public Works requested the State Engineer and Surveyor to prepare plans, specifications and estimates for rebuilding Searles waste weir No. 9 on the Champlain canal. The old structure was built of rubble masonry laid in mortar, and of wood, and was regarded as unsafe.

The plans for the new structure provided for the use of concrete and steel on a pile and timber foundation. After the excavation for the foundation was made, it was thought best to use concrete and timber grillage on the hard clay for a foundation in place of the piles and timber provided for in the original plan.

FOR REBUILDING AQUEDUCT NO. 3, ON THE CHAMPLAIN CANAL, NEAR FORT MILLER, N. Y.

Chapter 311, Laws of 1900.

Reardon & Burnham, contractors.

Ralph Russell, engineer in charge.

Plans approved by Canal Board, October 22, 1900. Contract dated, November 21, 1900. Contract to be completed, April 1, 1901. Work started, December, 1900. Contract completed, April, 1901.

Engineer's estimate (original)	$5,703 00
Final estimate	6,749 00

The masonry on the towpath end and the timber trunk were in need of repairs, and the Superintendent of Public Works requested the State Engineer and Surveyor to prepare plans for such repairs.

The work done consisted of rebuilding the masonry on the towpath end of the structure, building a new timber trunk with improved waste-gates and building about 200 linear feet of vertical wall on the towpath side just north of the structure. All masonry is founded on solid rock.

SARANAC DAM AND LOCK.

The work of completing the dam across the Saranac River near Saranac Lake and building a lock in the end of the dam and excavating a channel approach to the lower entrance to the lock, under chapter 627, Laws of 1898, chapter 417, Laws of 1900, chapter 427, Laws of 1900 and chapter 688, Laws of 1901, is practically completed.

IMPROVING SHINNECOCK CANAL.

Chapter 419, Laws of 1900.

On November 1, 1900, a contract was made with Brummelkamp & Lane for the improvement of the Shinnecock and Peconic canal upon plans prepared during the last fiscal year. Actual work was started about May 15, 1901, and is still in progress.

CLEANING OF BOND CREEK AND WOOD CREEK.

Chapter 683, Laws of 1901.

An examination and report was made in August, 1901, the work being done by the forces of the Superintendent of Public Works. The channels have been cleared of brush and straightened and many bars removed, greatly increasing the capacity of the streams.

The disbursement of the funds in several appropriations has been made on this division, among which are:

Chapter 569, Laws of 1899, and chapter 645, Laws of 1901.—For copying and preserving old maps, survey notes, etc.

Chapter 569, Laws of 1899, and chapter 419, Laws of 1900.—For making examination of monuments and surveys and maps of the boundary lines of the State, etc.

Chapter 386, Laws of 1900, and chapter 645, Laws of 1901.—For the topographic survey; and

Chapter 420, Laws of 1900, and chapter 645, Laws of 1901.—For the hydrographic work connected with the measurements of the volume of streams and flow of water in cooperation with the United States Geological survey.

Chapter 569, Laws of 1899.—For making blue line maps of the Erie, Oswego and Champlain canals.

Chapter 419, Laws of 1900.—For making surveys for the State Court of Claims.

Chapter 419, Laws of 1900, and chapter 645, Laws of 1901.—For making surveys for the Forest Preserve Board.

Chapter 439, Laws of 1900.—For survey of boundary line between Herkimer and Hamilton counties.

Chapter 411, Laws of 1900.—For the Barge Canal survey.

HIGHWAY IMPROVEMENT.

Under chapter 115, Laws of 1898.

There have been 34 roads under contract on this division during the past year, having a total length of about 130 miles. The progress made during the year has not been satisfactory, as most of the roads will not be completed this season. There are, however, several good reasons for the delay in the completion of these contracts.

The law making the appropriation for the State's share of the cost of the roads was not passed and signed early enough to permit contracts to be advertised and awarded until the season was well advanced. Most of the contractors did not have the required plant and, in some cases, lacked the experience necessary to start their work promptly and to carry it on expeditiously. It seemed to be impossible to have orders for new road-building plants during the past season filled promptly, and in many cases it was several weeks after the contract was awarded before the work was organized and was progressing at a rate that was anywhere near the full capacity of the plant.

Another reason for the delay this year was the excessive rainfall during the spring and summer, the past season having the greatest rainfall in many years in eastern New York. On many roads the roadway was simply a mass of mud over half the time. While in this wet condition it was difficult to do the grading and impossible to lay and roll the stone for the macadam. As we do not require a sand, gravel or Telford foundation for the stone, it is necessary that the sub-grade be dry and hard while the stone is being spread and rolled.

DELAWARE TURNPIKE, SECTION 1, ROAD NO. 7, ALBANY COUNTY, N. Y.

Length of road, 1.04 miles.

Width of macadam, 15 feet.

Width of roadway, 22 feet.

Engineer's estimate of total cost, $13,256.

Contract dated, May 12, 1900.

Work started, May, 1900.

Work completed to October 1, 1901, 99.9 per cent.

Contractors, C. H. Lutjens & Son. Assigned by them on April 15, 1901, to Donovan Bros.

Engineer in charge, T. A. Hendrickson.

This road starts at the southwesterly city line of Albany and crosses the Normanskill at Normansville. The old road here had a very steep grade of over 14 per cent. where it entered the valley of the Normanskill and also a steep grade in leaving this valley. The new road has a new location, which has a grade of about 3 per cent. for the most of the distance, and nothing over 5 per cent. The weight of all loads entering and leaving the city of Albany from the southwesterly portion of the county was determined by the load which could be drawn up these hills. With the new grades, as heavy loads can be drawn in and out of this valley as on other portions of the road.

TROY AND GREENBUSH ROAD NO. 11, SECTION 1, RENSSELAER COUNTY, N. Y.

Length of road, 1.03 miles.

Width of macadam, 15 feet.

Width of roadway, 22 feet.

Engineer's estimate of total cost, $10,714.60.

Contract date, July 21, 1899.

Work started, August, 1899.

Work finished, November, 1900.

Amount of final estimate, $7,907.50.

Contractor, George A. Rogers.

Engineer in charge, F. N. Sanders.

Road No. 11 starts at the southerly city line of Troy and ends at a point 1.03 miles southerly, and is one of the main roads from this section leading into Troy. The bottom course is of limestone 4 inches thick, the top course of trap rock 2 inches thick, and limestone screenings were used throughout as a binder. A great improvement was made in the grade near the

city line of Troy, where a 14 per cent. grade was reduced to 6.71 per cent. by means of a deep cut and the adjacent fill.

This road will connect with road No. 26 (now under contract) on the south. The two roads will form a beautiful drive overlooking the Hudson valley, between the city of Troy and the city of Rensselaer, on the east side of the Hudson River opposite Albany.

FRANKFORT AND UTICA ROAD NO. 14, SECTION 1, HERKIMER COUNTY, N. Y.

Length of road, 1.11 miles.

Width of macadam, 15 feet.

Width of roadway, 22 feet.

Engineer's estimate of total cost, $7,942.

Contract dated, May 8, 1900.

Work started, June, 1900.

Work finished, August, 1901.

Contractor, Fred G. Kerivan.

Engineer in charge, A. M. Evans to October 10, 1900; after October 10, 1900, William Van Epps.

After completing 78 per cent. of this work in the year 1900, the contractor refused to complete the work in the spring of 1901, and it was finished by the State Engineer and Surveyor. The total cost of the road is $8,231.65.

The road starts at the westerly village line of Frankfort and extends in a westerly direction parallel to the Erie canal for a distance of 1.11 miles toward Utica. It is one of the principal highways in the Mohawk valley on this side of the river and has a very heavy traffic. The bottom and top courses are each 3 inches thick and consist of Little Falls gneiss rock with limestone screenings for binder throughout.

ULSTER AND DELAWARE TURNPIKE, SECTION 1, ROAD NO. 16, ULSTER COUNTY, N. Y.

Length of road, 5.66 miles.

Width of macadam, 12 feet.

Width of roadway, 16 feet.

Engineer's estimate of total cost, $30,040.

Contract dated, May 14, 1900.

Work started, June, 1900.

Work finished, November, 1900.

Amount of final estimate, $27,040.48.

Contractors, Donovan Brothers.

Engineer in charge, W. J. Gilmour.

Road No. 16 starts in the village of Phoenicia and extends down the valley of Esopus Creek to the town line of Olive, and is a portion of the principal highway in this section. It is expected that this road will be extended northwesterly through Delaware county and southeasterly to the Hudson River at Kingston. When completed this will provide a beautiful highway through the Catskill mountains from the Hudson River to the central part of the State.

HASTINGS–ARDSLEY ROAD NO. 17, WESTCHESTER COUNTY, N. Y.

Length of road, 0.6 mile.

Width of macadam, 16 feet.

Width of roadway, 22 feet.

Engineer's estimate of total cost, $5,445.

Contract dated, May 12, 1900.

Work started, August, 1900.

Work finished, August, 1901.

Contractors, C. H. Lutjens & Son.

Engineers in charge, Ralph Russell and E. C. Clark.

After completing 99 per cent. of this work in 1900, the contractors, C. H. Lutjens & Son, refused to finish the work, and the remainder of the work was re-let to Harry L. Smith, who completed the contract in August, 1901.

Road No. 17 starts at the northerly village line of Hastings and extends to the village line of Ardsley. The bottom course of 4 inches is of local stone and the top course of 2 inches of trap rock. Limestone screenings were used throughout as a binder.

This is the southern part of a beautiful macadam highway, extending up the valley of the Sawmill River from Hastings northerly across the county to the Putnam county line on the westerly side of Westchester county.

ARDSLEY–ELMSFORD ROAD NO. 18, SECTION 1, WESTCHESTER COUNTY, N. Y.

Length of road, 3.06 miles.

Width of macadam, 16 feet.

Width of roadway, 22 feet.

Engineer's estimate of total cost, $26,798.

Contract dated, May 12, 1900.

Work started, June, 1900.

Contractors, C. H. Lutjens & Son.

Engineers in charge, Ralph Russell and G. A. Ensign in 1900, Ralph Russell and F. S. Strong in 1901.

After completing 33 per cent. of the road in 1900, the contractors, C. H. Lutjens & Son, refused to finish the work in the spring of 1901, and the remainder of the work was re-let to the Bellew & Merrit Company, which has completed 38 per cent. of its contract up to October 1, 1901.

Road No. 18 starts at the north village line of Ardsley and ends near Elmsford station. The bottom course of 4 inches is formed of local stone and other stone of similar quality, and the top course of 2 inches is of trap rock. Limestone screenings were used for a binder for the top course and local stone screenings for the bottom course.

This road will form part of the west side highway through the county connecting with road No. 17 on the south and road No. 34 on the north.

MAMARONECK–WHITE PLAINS ROAD NO. 19, WESTCHESTER COUNTY, N. Y.

Length of road, 2.05 miles.

Width of macadam, 16 feet.

Width of roadway, 22 feet.

Engineer's estimate of total cost, $29,222.

Contract dated, July 23, 1900.

Work started, August, 1900.

Work finished, October, 1901.

Amount of final estimate, $23,951.51.

Contractor, Daniel Murray.

Engineers in charge, Ralph Russell and Perry Filkin.

Road No. 19 starts at William McCabe's on Weaver Street in the town of Mamaroneck and extends to the old Mamaroneck-White Plains road in the town of Scarsdale. The bottom course of 4 inches is of local gneiss rock and the top course of 2 inches of trap rock from Connecticut. Limestone screenings were used throughout as a binder.

This is the southern part of a fine macadam highway extending from Long Island Sound northerly across the county to the Putnam county line on the easterly side of Westchester county.

WHITE PLAINS–ARMONK ROAD NO. 20, SECTION 1, WESTCHESTER COUNTY, N. Y.

Length of road, 3.77 miles.

Width of macadam, 14 feet.

Width of roadway, 20 feet.

Engineer's estimate of total cost, $31,545.

Contract dated, May 12, 1900.

Work started, June, 1900.

Work completed to October, 1901, 99 per cent.

Contractors, C. H. Lutjens & Son.

Engineers in charge, Ralph Russell and L. L. Melius.

The contractors, C. H. Lutjens & Son, completed 79 per cent. of the work in 1900, but in the spring of 1901 refused to complete the work and it was re-let to G. H. Smith, who will finish the contract in November, 1901.

Road No. 20 starts at the northerly corporation line of White Plains and extends northerly to a cross road leading to King Street. The bottom course of 4 inches is of a local granitic rock and the top course of 2 inches is of trap rock. Limestone

screenings were used throughout as a binder. This road will form part of the east side highway across the county connecting with road No. 35 on the north. It will form a delightful drive for people of White Plains and vicinity, winding along the easterly shore of the beautiful Kensico reservoir, which furnishes a portion of New York city's water supply.

LOUDON ROAD NO. 22, SECTION 1, ALBANY COUNTY, N. Y.

Length of road, 3.41 miles.

Width of macadam, 16 feet.

Width of roadway, 22 feet.

Engineer's estimate of total cost, $37,115.

Contract dated, June 25, 1900.

Work started, July, 1900.

Work finished, September, 1901.

Amount of final estimate, $32,615.

Contractor, T. H. Karr.

Engineers in charge, F. N. Sanders, until June 20, 1901; after this date, F. B. Morss.

Road No. 22 starts at the northerly city line of Albany and extends in a northerly direction to the M. E. church in the village of Newtonville. The bottom course of 4 inches is of Clinton Point limestone, except about a mile which is of trap rock. The top course of 2 inches is of trap rock. Clinton Point limestone screenings were used throughout as a binder.

When section 2 of this road is built it will connect the city of Albany and the city of Cohoes, and will form a beautiful drive overlooking the Hudson River.

TROY AND BRUNSWICK ROAD NO. 25, SECTION 2, RENSSELAER COUNTY, N. Y.

Length of road, 3.05 miles.

Width of macadam, 15 feet.

Width of roadway, 22 and 25 feet.

Engineer's estimate of total cost, $24,926.

Contract dated, July 16, 1901.

Contractor, T. H. Karr.

Engineer in charge, F. B. Morss.

At the request of a number of people living adjacent to this road, who did not want the road under construction at the season when crops were being moved to market, the contractor confined his operations this year to preparing the stone for the crusher in the quarry. It is expected that he will start the work of construction early in the spring of 1902.

This road starts about one-half mile northeasterly from the city line of Troy and ends about 300 feet westerly from the brick church at the intersection of the Stone road with the road to Cropseyville, and it is proposed to use crushed local quartzite for both courses on this road.

Road No. 25 is one of the principal highways leading from Troy easterly to the New England States. It connects on the west with road No. 10, finished last year, and will connect on the east with road No. 84, to be started next year. It has a very heavy traffic, and was macadamized many years ago, but is now very rough.

TROY AND GREENBUSH ROAD NO. 26, SECTION 2, RENSSELAER COUNTY, N. Y.

Length of road, 2.59 miles.

Width of macadam, 16 feet.

Width of roadway, 22 feet.

Engineer's estimate of total cost, $23,576.30.

Contract dated, June 20, 1901.

Work started, July, 1901.

Work completed to October 1, 1901, 22 per cent.

Contractor, town of North Greenbush.

Engineer in charge, A. M. Evans.

Road No. 26 starts from a point about 120 feet south of the house of James Wendell and ends at the intersection of the road to Bath at Defreestville. The bottom course of 4 inches will be of Clinton Point limestone and the top course of 2 inches will be of trap rock. Clinton Point limestone screenings will

be used throughout as a binder. This road is a continuation of road No. 11, and when completed will form the principal highway between Troy and Rensselaer on the east side of the Hudson River, opposite Albany.

ULSTER AND DELAWARE TURNPIKE, SECTION 3, ROAD NO. 31, ULSTER COUNTY, N. Y.

Length of road, 5.72 miles.

Width of macadam, 12 and 16 feet.

Width of roadway, 16 and 22 feet.

Engineer's estimate of total cost, $41,728.

Contract dated, June 10, 1901.

Work started, June, 1901.

Work completed to October 1, 1901, 41 per cent.

Contractor, town of Shandaken.

Engineer in charge, F. N. Sanders.

Road No. 31 starts at the village line of Pine Hill and extends southeasterly through the village of Shandaken. This road is a portion of the old Ulster and Delaware turnpike leading from Kingston to central New York, and is one of the principal highways in this section of the State. The bottom course of 3 inches is of local bluestone and crushed bowlders and the top course of 3 inches is of the same materials. Local screenings are used as a binder throughout.

Road No. 31, with the Ulster and Delaware turnpike, section 1 (finished last year), and the Ulster and Delaware turnpike, section 2 (expected to start next year), will form one of the most beautiful drives in the State, winding along the valley of the Esopus Creek through the Catskill mountains for a distance of nearly 20 miles.

AMSTERDAM–MINAVILLE ROAD NO. 32, MONTGOMERY COUNTY, N. Y.

Length of road, 2.65 miles.

Width of macadam, 12 feet.

Width of roadway, 22 feet.

Engineer's estimate of total cost, $17,510.

Contract dated, June 5, 1901.

Work started, June, 1901.

Work completed to October 1, 1901, 45 per cent.

Contractors, Snell Brothers.

Engineer in charge, O. J. Dempster.

This road starts at the city line of Amsterdam and extends in a southerly direction to a point near the village of Minaville. It is one of the principal highways entering Amsterdam from the south. Both the bottom and top courses of the entire road, except the mile nearest Amsterdam, are formed of crushed cobble stone. Local stone screenings were used in the bottom course and limestone screenings in the top course. The mile of road located nearest Amsterdam is to be made of limestone with limestone screenings throughout, as it is nearly all a 5 or 6 per cent. grade.

Road No. 32 was a heavy clay road, and, before improvement, was almost impassable in wet weather.

GLOVERSVILLE-MAYFIELD ROAD NO. 33, FULTON COUNTY, N. Y.

Length of road, 4.04 miles.

Width of macadam, 16 feet.

Width of roadway, 22 feet.

Engineer's estimate of total cost, $33,720.

Contract dated, June 5, 1901.

Work started, June, 1901.

Work completed to September 16, 1901, 33 per cent.

Contractor, John R. Briggs.

Engineer in charge, H. W. DeGraff.

This road starts at the city line of Gloversville and extends northerly to the corporation line of the village of Mayfield. The bottom and top courses and screenings were all obtained by crushing a hard local granitic rock.

Road No. 33 is the principal highway between the city of Gloversville and the village of Mayfield.

Two dangerous grade crossings on the Fonda, Johnstown and Gloversville Railroad are avoided by adopting a new location for

the improved highway about 1,000 feet in length, keeping the highway on the west side of the railroad.

ARDSLEY–ELMSFORD ROAD NO. 34, SECTION 2, WESTCHESTER COUNTY, N. Y.

Length of road, 2.16 miles.

Width of macadam, 16 feet.

Width of roadway, 22 feet.

Engineer's estimate of total cost, $21,838.

Contract dated, May 31, 1901.

Work started, June, 1901.

Work completed to October 1, 1901, 78 per cent.

Contractors, McCabe & Duffy.

Engineers in charge, Ralph Russell and F. S. Strong.

This road starts at Elmsford station and extends northerly to the Westchester County Farm. From station 161 + 85 to station 207 both bottom and top courses are of trap rock, with limestone screenings as a binder. From station 207 to station 242 the bottom course is of local stone and local stone screenings, and the top course of trap rock with limestone screenings. From station 242 to end of road at the (Westchester County Farm), the botom course is of local stone and local stone screenings and the top course of local stone and limestone screenings.

Road No. 34 forms part of the west side highway across the county, joining road No. 18 on the south and road No. 52 on the north.

WHITE PLAINS–ARMONK ROAD NO. 35, SECTION 2, WESTCHESTER COUNTY, N. Y.

Length of road, 3.21 miles.

Width of macadam, 14 feet.

Width of roadway, 20 feet.

Engineer's estimate of total cost, $27,023.

Contract dated, July 22, 1901.

Work started, August, 1901.

Work completed to October 1, 1901, 24 per cent.

Contractors, Eldert & Johannknecht.

Engineers in charge, Ralph Russell and L. L. Melius.

This road starts at the cross road leading to King Street and ends at the cross road to Port Chester. Both bottom and top courses are to be made of local stone and local stone screenings are used for a binder, with the exception that one-half of the screenings for the top course are to be of limestone.

Road No. 35 forms part of the east side highway across the county, joining road No. 20 on the south and road No. 50 on the north.

GRIFFINS CORNERS ROAD NO. 36, DELAWARE COUNTY, N. Y.

Length of road, 1.57 miles.

Width of macadam, 12 feet.

Width of roadway, 16 feet.

Engineer's estimate of total cost, $6,160.

Contract dated, July 18, 1901.

Work started, August, 1901.

Work completed to October 1, 1901, 31 per cent.

Contractor, town of Middletown.

Engineers in charge, F. N. Sanders and G. H. Penfield.

This road starts at the west line of Charles Liedman's farm and extends for 1.57 miles through the unincorporated village of Griffins Corners. Both courses of stone and the screenings for the binder are obtained by crushing local bluestone, cobble stones and bowlders.

Road No. 36 is a continuation of the Ulster and Delaware turnpike, section 3, in Ulster county, with a short distance between. It is just over the divide between the Hudson River watershed and the Delaware River watershed, on the summit of the Catskill mountains at this place. It is expected to extend this road about 6 miles farther toward Margaretville next year.

SAUGERTIES-WOODSTOCK ROAD NO. 37, SECTION 1, ULSTER COUNTY, N. Y.

Length of road, 4 miles.

Width of macadam, 12 feet.

Width of roadway, 16, 18, 20 and 22 feet.

Engineer's estimate of total cost, $22,910.

Contract dated, June 10, 1901.

Work started, June, 1901.

Work completed to October 1, 1901, 46 per cent.

Contractor, Edgar Snyder & Co.

Engineer in charge, F. M. Williams.

Road No. 37 starts at the bridge over the Sawkill at Bearsville and extends easterly through the village of Woodstock to the town line of Woodstock. Both bottom and top courses and screenings for the binder are obtained by crushing the local bluestone, cobble stones and boulders.

This road is in the valley of the Sawkill along the base of Overlook Mountain in the Catskills. The road forms a straight line for more than a mile between Bearsville and Woodstock.

SAUGERTIES–WOODSTOCK ROAD NO. 38, SECTION 2, ULSTER COUNTY, N. Y.

Length of road, 4.9 miles.

Road No. 38 is the only road on the Eastern division that was not contracted for during the past year. It was advertised twice, but no bids were received within the Engineer's estimate. It will be built next year without doubt.

This road is one of the principal roads approaching Saugerties from the west and has a heavy traffic of bluestone coming to market on the Hudson River.

WATERFORD–MECHANICVILLE ROAD NO. 39, SECTION 1, SARATOGA COUNTY, N. Y.

Length of road, 1.51 miles.

Width of macadam, 16 feet.

Width of roadway, 22 feet.

Engineer's estimate of total cost $11,970.

Contract dated, July 22, 1901.

Work started, August, 1901.

Work completed to October 1, 1901, 34 per cent.

Contractor, E. & J. E. Martin.

Engineer in charge, G. A. Ensign.

This road starts from a point about 1,420 feet north of the village line of Waterford and extends northerly to the town line of Half Moon. The bottom course of 4 inches is of Canajoharie limestone, and the top course of 2 inches of trap rock. Canajoharie limestone screenings are being used throughout as a binder.

Road No. 39 and road No. 59, which joins it on the north, constitute the principal highway on the west side of the Hudson River between Waterford, Cohoes, Troy and Mechanicville.

DELAWARE TURNPIKE, SECTION 2, ROAD NO. 41, ALBANY COUNTY, N. Y.

Length of road, 2.74 miles.

Width of macadam, 15 feet.

Width of roadway, 22 feet.

Engineer's estimate of total cost, $22,497.20.

Contract dated, June 5, 1901.

Work started, June, 1901.

Work completed to October 1, 1901, 38 per cent.

Contractor, Callanan Road Improvement Co.

Engineer in charge, T. A. Hendrickson.

Road No. 41 starts at a point about 300 feet southwest of the house of M. H. Bender, where road No. 7 ends, and ends about 600 feet southwest of the cross road to Slingerlands. Both bottom and top courses and the screenings used for binder are limestone from the Callanan quarries at South Bethlehem, Albany county, N. Y.

For 200 years all the traffic entering Albany from the southwest has had to drag through sand nearly hub deep, on this road. A fine macadam road will soon permit the drawing of as heavy loads here as on the pavements of Albany. It is expected to extend this road to Slingerlands, Voorheesville, Guilderland and Altamont, also to Union Church and Clarksville.

NEWBURGH-WOODBURY ROAD NO. 42, ORANGE COUNTY, N. Y.

Length of road, 11 miles.

Width of roadway, 16 and 22 feet.

Engineer's estimate of total cost, $22,330.

Contract dated, June 18, 1901.

Work started, July, 1901.

Work completed to October 1, 1901, 30 per cent.

Contractors, Board of Supervisors of Orange County.

Engineers in charge, C. H. Flanigan and H. P. Willis.

Road No. 42 starts at the city line of Newburgh near the Quassaic bridge and extends southerly to the Moodna Creek at Orr's Mills, where it follows the valley of this and Woodbury creek to the arch bridge over the Woodbury creek at Woodbury. It is expected that this road will be one of the main highways from New York to Newburgh on the west side of the Hudson River. The grades are all reduced to 5 per cent., the drainage is greatly improved and the surface will be covered with gravel or shale rock.

COCHECTON TURNPIKE SECTION 2, ROAD NO. 43, ORANGE COUNTY, N. Y.

Length of road, 7.55 miles.

Width of roadway, 22 feet.

Engineer's estimate of total cost, $22,928.

Contract dated, June 18, 1901.

Work started, July, 1901.

Work completed to October 1, 1901, 19 per cent.

Contractors, Board of Supervisors of Orange County.

Engineers in charge, C. H. Flanigan and C. H. McCulloch.

Road No. 43 starts from the village line of Montgomery and extends easterly to within about 2 miles of the city line of Newburgh. The grades on this road are all lessened so that none exceeds 6 per cent. and the drainage is greatly improved. The tops of the rocky knolls are removed, and the shale rock obtained therefrom is placed on the surface of the road.

The Cochecton turnpike has been for many years one of the principal highways across Orange county, from the Hudson River at Newburgh to the Delaware River at Cochecton, in Sullivan county. It is expected to extend this road to the city line of Newburgh next year.

GOSHEN–FLORIDA ROAD NO. 44, ORANGE COUNTY, N. Y.

Length of road, 4.22 miles.

Width of roadway, 18 feet.

Engineer's estimate of total cost, $9,690.

Contract dated, June 18, 1901.

Work started, September, 1901.

Work completed to October 1, 1901, 15 per cent.

Contractors, Board of Supervisors of Orange County.

Engineers in charge C. H. Flanigan and H. Eltinge Breed.

Road No. 44 starts at the village line of Goshen and extends in a southerly direction to the village of Florida. The heavy grades on this road are reduced so that none exceeds 6 per cent., the drainage is greatly improved and the surface is covered with gravel. It is expected to extend this road to the village of Warwick on the southerly side of the county next year.

MIDDLETOWN–PINE BUSH ROAD NO. 45, ORANGE COUNTY, N. Y.

Length of road, 9.25 miles.

Width of roadway, 16 feet.

Engineer's estimate of total cost, $13,770.

Contract dated, June 18, 1901.

Work started, July, 1901.

Work completed to October 1, 1901, 27 per cent.

Contractors, Board of Supervisors of Orange County.

Engineers in charge, C. H. Flanigan and L. G. Fenton.

Road No. 45 starts at the village of Pine Bush and extends southerly to within about 1 mile of the toll road leading to Middletown, with which it is expected to connect next year. The grades on this road were all reduced so that none exceeds 6 per cent., and the drainage is greatly improved. The surface is covered with a layer of gravel.

TURNERS–MONROE ROAD NO. 46, ORANGE COUNTY, N. Y.

Length of road, 1.59 miles.

Width of roadway, 22 feet.

Contract dated, June 18, 1901.

Contractors, Board of Supervisors of Orange County.

The plans for road No. 46 provide for a new location to get around a hill near the village of Monroe instead of following the old road over the hill with steep grades on both sides. This road would be of no use unless the village of Monroe built about 400 feet of roadway within its limits to connect with road No. 46, where it ends at the village line. Up to this date the village has made no arrangements to build this 400 feet of road, and this contract will not be permitted to start until it is certain that the village of Monroe will make such connection.

ARMONK–MT. KISCO ROAD NO. 50, WESTCHESTER COUNTY, N. Y.

Length of road, 4.44 miles.

Width of macadam, 12 feet.

Width of roadway, 20 feet.

Engineer's estimate of total cost, $36,062.

Contract dated, July 22, 1901.

Work started, September, 1901.

Work completed to October 1, 1901, 3 per cent.

Contractors, Eldert & Johannknecht.

Engineers in charge, Ralph Russell and L. L. Melius.

The bottom and top courses will be formed of local granitic rock, the screenings for the bottom course will be local stone and for the top course half limestone and half local stone.

Road No. 50 forms part of the east side highway across the county, joining road No. 35 on the south and road No. 51 on the north.

MT. KISCO–BEDFORD ROAD NO. 51, WESTCHESTER COUNTY, N. Y.

Length of road, 5.04 miles.

Width of macadam, 12 feet.

Width of roadway, 20 feet.

Engineer's estimate of total cost, $40,584.

Contract dated, July 24, 1901.

Work started, August, 1901.

Work completed to October 1, 1901, 10 per cent.

Contractors Bellew & Merritt Co.

Engineers in charge, Ralph Russell and R. J. Marcher.

The bottom and top courses will be formed of local granitic rock, the screenings for the bottom course will be local stone and for the top course half limestone and half local stone.

Road No. 51 forms part of the east side highway across the county, joining road No. 50 on the south.

UNIONVILLE-MCKEELS CORNERS ROAD NO. 52, WESTCHESTER COUNTY, N. Y.

Length of road, 3.69 miles.

Width of macadam, 12 feet.

Width of roadway, 20 feet.

Engineer's estimate of total cost, $30,411.

Contract dated, May 31, 1901.

Work started, July, 1901.

Work completed to October 1, 1901, 10 per cent.

Contractors, McCabe & Duffy.

Engineers in charge, Ralph Russell and F. S. Strong.

The bottom and top courses on this road are formed of local granitic stone. Local screenings are used for the bottom course and limestone screenings for the top course as binder.

Road No. 52 forms part of the west side highway across the county, joining road No. 34 on the south at the Westchester County Farm and road No. 53 on the north.

MCKEELS CORNERS-BRIAR CLIFF MANOR ROAD NO. 53, WESTCHESTER COUNTY, N. Y.

Length of road, 1.76 miles.

Width of macadam, 12 feet.

Width of roadway, 20 feet.

Engineer's estimate of total cost, $13,968.

Contract dated, May 31, 1901.

Contractors, McCabe & Duffy.

Up to October 1, 1901, work had not been started on this road.

Road No. 53 will form part of the west side highways across the county, joining road No. 52 on the south and road No. 54 on the north.

BRIAR CLIFF MANOR–ECHO LAKE ROAD NO. 54, WESTCHESTER COUNTY, N. Y.

Length of road, 2.65 miles.

Width of macadam, 12 feet.

Width of roadway, 22 feet.

Engineer's estimate of total cost, $22,540.

Contract dated, July 17, 1901.

Contractors, McCabe & Duffy.

Up to October 1, 1901, work had not been started on this road.

Road No. 54 will form part of the west side highway across the county, joining road No. 53 on the south.

HOAGS CORNERS ROAD NO. 55, RENSSELAER COUNTY, N. Y.

Length of road, 3.15 miles.

Width of roadway, 16 feet.

Engineer's estimate of total cost, $9,955.

Contract dated, July 16, 1901.

Work started, July, 1901.

Work completed to October 1, 1901, 47 per cent.

Contractor, T. H. Karr.

Engineer in charge, Frank Roberts.

This road is on the direct route from Troy, N. Y., to Pittsfield, Mass. It starts at Hoags Corners and extends northerly to the Troy turnpike. The grades, which, in some cases, were very steep, are all reduced so that they will not exceed 6 per cent. The drainage is greatly improved by providing side ditches and giving the road the proper crown. The material on the surface, which is rolled with a 10-ton roller, is the best that can be found in the necessary excavation.

PLATTSBURG–KEESEVILLE ROAD NO. 56, SECTION 1, CLINTON COUNTY, N. Y.

Length of road, 2.82 miles.

Width of macadam, 16 feet.

Width of roadway, 22 feet.

Engineer's estimate of total cost, $18,910.

Contract dated, June 7, 1901.

Work started, June, 1901.

Work completed to October 1, 1901, 56 per cent.

Contractors, Prescott & Buckley Construction Company.

Engineers in charge, Clark Brown until August 16, 1901; after this date, M. H. Ranney.

This road starts at the Chateaugay railroad crossing and extends southerly to the cross road to Lake Champlain near Salmon River, and is one of the principal roads leading into Plattsburg from the southwest. It was a very sandy road and almost impassable with a heavy load. It is being macadamized with limestone from the bed of the Salmon River in both courses and limestone screenings are being used as a binder throughout.

WINDSOR ROAD NO. 57, SECTION 1, CLINTON COUNTY, N. Y.

Length of road, 1 mile.

Width of macadam, 16 feet.

Width of roadway, 22 feet.

Engineer's estimate of total cost, $7,780.

Contract dated, June 7, 1901.

Work started, September, 1901.

Contractor, Prescott & Buckley Construction Company.

Engineer in charge, M. H. Ranney.

This road starts at the westerly village line of Rouses Point and extends westerly toward the village of Champlain, a distance of 1 mile. It is proposed to form the bottom and top courses of limestone and to use limestone screenings throughout.

GLENS FALLS–SARATOGA ROAD NO. 58, SECTION 1, SARATOGA COUNTY, N. Y.

Length of road, 6.06 miles.

Width of macadam, 12 feet.

Width of roadway, 16 and 22 feet.

Engineer's estimate of total cost, $36,532.

Contract dated, June 4, 1901.

Work started, June, 1901.

Work completed to October 1, 1901, 46 per cent.

Contractors, Reardon & Burnham.

Engineer in charge, W. J. Gilmour.

Road No. 58 was the most sandy and the worst portion of the road between Saratoga and Glens Falls. The bottom and top courses and the screenings for binder are obtained by crushing the local granitic rock. Two steep grades are reduced on this road so as not to exceed 6 per cent., by making heavy cuts and adjacent fills.

WATERFORD–MECHANICVILLE ROAD NO. 59, SECTION 2, SARATOGA COUNTY, N. Y.

Length of road, 5.03 miles.

Width of macadam, 16 feet.

Width of roadway, 22 and 28 feet.

Engineer's estimate of total cost, $36,532.

Contract dated, July 27, 1901.

Contractors, E. & J. E. Martin.

Up to October 1, 1901, work had not been started on this road, which is a continuation of road No. 39. When both roads are completed the main highway on the west side of the Hudson River from Troy and Waterford to the north will be macadamized between Waterford and Mechanicville.

Recapitulation of Work Done to September 30, 1901.

Counties.	Miles under contract [illegible] September 30, 1901.	Miles of plans and estimates completed prior to September 30, 1900.	Miles of plans and estimates completed prior to September 30, 1901.	Miles of plans and estimates made during year ending September 30, 1901.	Miles of surveys made during year ending September 30, 1901.	Miles of contracts completed prior to September 30, 1900.	Miles of contracts completed prior to September 30, 1901.	Miles of contracts completed during year ending September 30, 1901.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

GENERAL COMMENTS.

The laws of this State that are supposed to provide for the proper maintenance of the highways are [illegible] and new laws that will [illegible] a better and more efficient system of road maintenance are very badly needed. In a large proportion of the towns the highway [illegible] and their pathmasters [illegible] assessed for highway [illegible] towns where a [illegible] is [illegible] nearly a [illegible] State [illegible] laws [illegible] provide for the maintenance of roads [illegible] under the Laws of 1898 [illegible] State [illegible] and [illegible] these [illegible] roads [illegible] these [illegible] New York State [illegible] the same degree [illegible]

[illegible]

have not been properly maintained. There should be some law permitting the officials in charge of the maintenance of highways to erect wire or "snow" fences on lands adjacent to portions of roads usually drifted full of snow. The law should also enable the highway officials to have sufficient funds at their disposal to remove snow from the roads and to do any other work required at short notice to keep the roads in proper condition for public use.

The elements, the shoes of horses, the wheels of vehicles, the ignorance, maliciousness, selfishness and carelessness of the people using the roads and owning the lands adjacent to them, and many other causes are constantly at work stopping the drainage and injuring the road. Unless there be an intelligent, conscientious and efficient system of maintenance, enforced by wise laws, to constantly repair these damages, these improved roads will very soon cease to be examples of what highways should be. They will be in a very poor state of repair and will be a standing hindrance to the success of the movement for better roads in the State.

To secure a better and more efficient system of road maintenance, the laws should make the county instead of the town the unit in charge of the roads and bridges and work under what is known as the "money" system. Each county should have its roads and bridges under the charge of one competent man. The salary should be sufficient to secure and retain a capable man and permit him to devote all his time to the work and enable him to give bonds for the proper expenditure of all funds. There should be such requirements for eligibility for this position as to make as difficult as possible the selection of an improper person. This man could be held responsible for the condition of all the roads and bridges of the county. The supervision of each road would have the advantage of the experience and knowledge that one man had acquired in the whole county. Steam rollers, dump wagons and improved and economical road machinery could be purchased, there being sufficient length of roads to keep them employed continuously by experienced and

competent men. The labor, materials and machinery could be selected, directed and used to much better advantage by the county than by the town.

This system would resemble somewhat the systems that have been found best and most efficient in the countries of Europe that have the best roads and that have the most experience in their care. It would tend to accord more with the system of centralized control and uniform methods which have been found to be most efficient and economical in the management of large, modern business enterprises.

This division has for the past fiscal year been in charge of Trevor C. Leutzé, division engineer, and H. A. Van Alstyne, resident engineer, to September 11, 1901, after that date in charge of H. A. Van Alstyne, acting division and resident engineer, and William B. Landreth, special resident engineer.

A statement of the engineering expenses of the division is hereto annexed, showing in detail the names of persons employed, time of service and compensation of each.

Very respectfully,

H. A. VAN ALSTYNE,

Acting Division and Resident Engineer.

Ordinary Repairs, Erie Canal.

(Chapter 570, Laws 1899; chapter 418, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
T. C. Leutzé	Division engineer	....	$3,000 per yr.	$2,000 03	....	$2,000 03
H. A. Van Alstyne	Resident engineer	....	2,400 per yr.	1,166 40	$24 71	1,191 11
Dorlon Clark	Assistant engineer	113	5 00 per day	565 00	7 61	572 61
A. M. Evans	Assistant engineer	14	5 00 per day	70 00	....	70 00
F. N. Sanders	Leveler	13	4 50 per day	58 50	....	58 50
F. M. Williams	Leveler	9	4 50 per day	40 50	2 48	42 98
R. S. Greenman	Leveler	211	4 50 per day	949 50	....	949 50
John A. O'Connor	Draftsman	29	4 50 per day	130 50	2 53	133 03
H. J. Richardson	Rodman	101	3 50 per day	353 50	1 10	354 60
Frank Roberts	Rodman	9	3 50 per day	31 50	3 08	34 58
W. J. Gilmour	Rodman	18	3 50 per day	63 00	8 99	71 99
F. G. Tilton	Chainman	24	2 50 per day	60 00	....	60 00
William Van Epps	Chainman	24	3 00 per day	72 00	....	72 00
George McDonald	Chainman	81	3 00 per day	243 00	3 35	246 35
Fred H. Owens	Chainman	26	2 50 per day	65 00	....	65 00
W. B. Strong	Chainman	52	2 50 per day	130 00	....	130 00
W. B. Strong	Chainman	26	3 00 per day	78 00	....	78 00
Parkes D. Wendell	Chainman	26	3 00 per day	78 00	....	78 00
W. J. Valleau	Financial clerk	153	5 00 per day	765 00	....	765 00
W. J. Valleau	Financial clerk	....	2,100 per yr.	116 67	....	116 67
Thomas F. Kelly	Stenographer	....	75 00 per mo.	225 00	....	225 00
A. P. Sullivan	Watchman	....	10 00 per mo.	40 00	....	40 00

Incidental Expenses.		$7,354 95
Stationery	$380 64	
Postage	59 46	
Telephone and telegraph	99 55	
Miscellaneous	799 96	
		1,339 61
Total		$8,694 56

Ordinary Repairs, Champlain Canal.

(Chapter 570, Laws 1899; chapter 418, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
T. C. Leutzé	Division engineer	....	$3,000 per yr.	$999 97	....	$999 97
H. A. Van Alstyne	Resident engineer	....	2,400 per yr.	508 58	$10 68	519 26
Dorlon Clark	Assistant engineer	6	5 00 per day	30 00	....	30 00
T. A. Hendrickson	Leveler	18	4 50 per day	81 00	....	81 00
R. S. Greenman	Leveler	103	4 50 per day	463 50	3 05	466 55
John A. O'Connor	Draftsman	7	4 50 per day	31 50	....	31 50
L. W. Cottrell	Draftsman	19	3 50 per day	66 50	....	66 50
H. J. Richardson	Rodman	137	3 50 per day	479 50	7 23	486 73
L. L. Melius	Chainman	14	3 00 per day	42 00	....	42 00
W. B. Strong	Chainman	27	3 00 per day	81 00	....	81 00
George McDonald	Chainman	28	3 00 per day	84 00	2 88	86 88
Fred H. Owens	Chainman	34	2 50 per day	85 00	....	85 00
F. G. Tilton	Chainman	10	2 50 per day	25 00	....	25 00
James T. Brady	Chainman	4	2 50 per day	10 00	3 08	13 08
W. J. Valleau	Financial clerk	79	5 00 per day	395 00	20	395 20
A. P. Sullivan	Watchman	...	10 00 per mo.	80 00	....	80 00
C. H. Fosdick	Laborer	10	2 00 per day	20 00	....	20 00

Incidental Expenses.		$3,509 67
Stationery	$156 40	
Livery	7 00	
Postage	36 04	
Telephone and telegraph	86 31	
Miscellaneous	560 19	
		845 94
Total		$4,355 61

Extraordinary Repairs, Erie Canal.

(Chapter 298, Laws 1890.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
H. A. Van Alstyne........	Resident engineer		$2,400 per yr.	$64 50	$4 56	$69 06
John A. O'Connor........	Draftsman............	12	4 50 per day	54 00	....	54 00
						$123 06

Incidental Expenses.

Livery	1 50
Total	$124 56

Extraordinary Repairs, Erie Canal.

(Waste Weir No. 8.) (Chapter 311, Laws 1900.)

Incidental Expenses.

Printing	$98 29

Bridge over Erie Canal, Town of Minden.

(Chapter 586, Laws 1890, chapter 457, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
[illegible]	Assistant engineer .	[illegible]	[illegible] per day	$[illegible]	$[illegible] 34	$[illegible] 34
[illegible]	[illegible]	[illegible]	2 50 per day	[illegible]	6 [illegible]	[illegible] 06
						$435 40

Incidental Expenses.

[illegible]	$64 45	
[illegible]	1 4[illegible]	
[illegible]	1 [illegible]	
[illegible]	3[illegible] [illegible]	
		105 46
Total		$540 86

Twenty-Third Street Bridge, Watervliet.

(Chapter 440, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Fred S. Strong	Leveler	105	$4 50 per day	$472 50	$5 10	$477 60
William Van Epps	Chainman	74	3 00 per day	222 00	80	222 80
A. S. Kinney	Laborer	128	2 00 per day	256 00	19 75	275 75
						$976 15
Incidental Expenses.						
Printing					$68 98	
Telegraph and telephone					1 06	
Postage					1 52	
Office rent					30 00	
Fuel and light					17 00	
Miscellaneous					55 29	
						173 85
Total						$1,150 00

Extraordinary Repairs, Champlain Canal.

(Chapter 208, Laws 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Dorlon Clark	Assistant engineer	14	$5 00 per day	$70 00	....	$70 00

Extraordinary Repairs, Champlain Canal.

Searles Waste Weir No. 9. (Chapter 311, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. M. Evans	Assistant engineer	17	$5 00 per day	$85 00	....	$85 00
Ralph Russell	Leveler	27	4 50 per day	121 50	$11 00	132 50
George A. Ensign	Leveler	77	4 50 per day	346 50	5 70	352 20
L. L. Melius	Chainman	89	3 00 per day	267 00	24 96	291 96
Fred H. Owens	Chainman	26	2 50 per day	65 00	....	65 00
						$926 66
Incidental Expenses.						
Printing					$94 65	
Telephone and telegraph					1 60	
Fuel and light					6 50	
Postage					3 70	
Miscellaneous					26 61	
						133 06
Total						$1,059 72

Extraordinary Repairs, Champlain Canal.

(Aqueduct No. 2.) (Chapter 311, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. M. Evans	Assistant engineer	10	$5 00 per day	$50 00	....	$50 00
Ralph Russell	Leveler	102	4 50 per day	459 00	$42 16	501 16
George A. Ensign	Leveler	14	4 50 per day	63 00	....	63 00
Perry Filkin	Leveler	14	4 50 per day	63 00	5 60	68 60
						$682 76
Incidental Expenses.						
Printing					$87 65	
Telephone and telegraph					3 80	
Fuel and light					13 16	
						104 61
Total						$787 37

Extraordinary Repairs, Champlain Canal.

(Chapter 311, Laws 1900.)

(Repairing and improving vertical walls—Sec. 2.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Fred G. Tilton	Chainman	52	$2 50 per day	$130 00	....	$130 00

Vertical Wall on Glens Falls Feeder near Power House of Electric Street Railway, Warren Co., N. Y.

(Chapter 438, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
W. J. Gilmour	Rodman	122	$3 50 per day	$427 00	$135 65	$562 65
Fred H. Owens	Chainman	49	2 50 per day	122 50	....	122 50
Fred. G. Tilton	Chainman	49	2 50 per day	122 50	....	122 50
						$807 65
Incidental Expenses.						
Printing					$33 26	
Postage					40	
Telegraph and telephone					29	
Miscellaneous					3 90	
						37 85
Total						$845 50

Bridge over Champlain Canal—Town of Waterford.

Chapter 629, Laws 1898; chapter 219, Laws 1899; chapter 443, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
F. N. Sanders	Leveler	117	$4 50 per day	$526 50	$9 80	$536 30
George H. Penfield	Rodman	2	3 50 per day	7 00	....	7 00
H. S. Miller	Chainman	139	2 50 per day	347 50	....	347 50
						$890 80
Incidental Expenses.						
Printing					$64 97	
Fuel and light					6 00	
Miscellaneous					70 83	
						141 80
Total						$1,032 60

Barge Canal Survey, Erie Canal.

(Chapter 411, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
B. T. Feeley	Supt. borings	5	$6 00 per day	$30 00	$4 00	$34 00
Patrick Navin	Foreman borings	5	3 25 per day	16 25	2 50	18 75
P. A. Grogan	Foreman borings	5	3 25 per day	16 25	2 50	18 75
John F. Tunney	Foreman borings	5	3 25 per day	16 25	2 50	18 75
George Kirk	Foreman borings	5	3 25 per day	16 25	2 50	18 75
Samuel Wood	Foreman borings	5	3 25 per day	16 25	2 50	18 75
John J. Desmond	Laborer	5	2 00 per day	10 00	2 50	12 50
Thomas F. Maloney	Laborer	5	2 00 per day	10 00	2 50	12 50
John Marra	Laborer	5	2 00 per day	10 00	2 50	12 50
James Hickey	Laborer	5	2 00 per day	10 00	2 50	12 50
John P. Seible	Laborer	5	2 00 per day	10 00	2 50	12 50
M. Murray	Laborer	5	2 00 per day	10 00	2 50	12 50
William Hayes	Laborer	5	2 00 per day	10 00	2 50	12 50
Ed. Hollihan	Laborer	5	2 00 per day	10 00	2 50	12 50
William Galvin	Laborer	5	2 00 per day	10 00	2 50	12 50
T. F. Crowley	Laborer	5	2 00 per day	10 00	2 50	12 50
James Driscoll	Laborer	5	2 00 per day	10 00	2 50	12 50
Thomas Shea	Laborer	5	2 00 per day	10 00	2 50	12 50
John Barter	Laborer	5	2 00 per day	10 00	2 50	12 50
James Cahill	Laborer	5	2 00 per day	10 00	2 50	12 50
Thomas Bowes	Laborer	5	2 00 per day	10 00	2 50	12 50
Eugene Reardon	Laborer	4	2 00 per day	8 00	2 00	10 00
J. R. Rush	Laborer	6	2 00 per day	12 00	10 00	22 00
John J. Allen	Clerk	...	....	....	11 74	11 74
Charles N. Kirby	Laborer	27	2 00 per day	54 00	....	54 00
						$412 99
Incidental Expenses.						
Office rent					$1 00	
Livery					148 74	
Miscellaneous					3 86	
						153 60
Total						$566 59

Barge Canal Survey—Head Office Payments.

(Chapter 411, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Elnathan Sweet	Advisory engineer	13	$100 00 per day	$1,300 00	$6 00	$1,306 00
T. W. Symons	Advisory engineer	10	100 00 per day	1,000 00	197 80	1,197 80
William H. Burr	Advisory engineer	10	100 00 per day	1,000 00	88 00	1,088 00
A. Noble	Advisory engineer	10	100 00 per day	1,000 00	201 25	1,201 25
George S. Morison	Advisory engineer	10	100 00 per day	1,000 00	92 00	1,092 00
D. J. Howell	Consulting engineer	....	5,000 per yr.	2,708 29	74 43	2,782 72
T. C. Lentzé	Consulting engineer	....	1,200 per yr.	1,200 00	27 62	1,227 62
Edward A. Bond	State engineer and surveyor	....	....	....	115 62	115 62
Wm. Pierson Judson	Deputy state engineer and surveyor	....	....	....	11 96	11 96
Irving J. Morris	Head clerk	....			22 30	22 30
James J. Overn	Special resident eng.	....	225 00 per mo.	1,412 50	411 10	1,823 60
William B. Landreth	Special resident eng.	....	225 00 per mo.	2,650 00	1,103 62	3,753 62
Emil Kuichling	Expert hydraulician	....	400 00 per mo.	2,453 33	115 82	2,569 15
E. C. Murphy	Hydraulician	57	5 00 per day	285 00	132 42	417 42
W. P. Boright	Hydraulician	172	5 00 per day	860 00	25 47	885 47
P. McNamara	Expert land appraiser	63	10 00 per day	630 00	35 29	665 29
S. J. Chapleau	Lock expert	....	175 00 per mo.	875 80	....	875 80
J. E. Boatrite	Bridge designer	....	150 00 per mo.	391 92	....	391 92
J. T. N. Hoyt	Bridge designer	....	160 00 per mo.	1,008 00	9 09	1,017 09
W. G. Stearns	Supt. borings	9	6 00 per day	54 00	17 31	71 31
George A. Hammond	Supt. borings	7	6 00 per day	42 00	19 20	61 20
B. T. Feely	Supt. borings	15	6 00 per day	90 00	10 53	100 53
J. H. Brace	Expert computer	....	225 00 per mo.	1,427 50	....	1,427 50
A. E. Broenniman	Expert computer	....	175 00 per mo.	1,105 50	....	1,105 50
A. A. Conger	Expert computer	....	150 00 per mo.	895 00	....	895 00
William E. Mott	Expert computer	....	125 00 per mo.	375 00	2 18	377 18
S. M. Purdy	Expert computer	....	100 00 per mo.	312 00	29 54	341 54
A. M. Fairlee	Expert computer	....	100 00 per mo.	300 00	....	300 00
A. L. Harriss	Expert computer	84	5 00 per day	420 00	....	420 00
Clinton G. Taylor	Expert computer	85	5 00 per day	425 00	....	425 00
W. A. Wansleben	Expert computer	97	5 00 per day	485 00	....	485 00
W. R. Ballard	Expert computer	85	5 00 per day	425 00	....	425 00
George F. Chism	Expert computer	136	5 00 per day	680 00	4 84	684 84
Walter Van Guysling	Expert computer	70	5 00 per day	350 00	....	350 00
F. Ahren	Expert computer	33	5 00 per day	165 00	....	165 00
Roger Miller	Expert computer	16	5 00 per day	80 00	....	80 00
John T. Parsons	Expert computer	28	5 00 per day	140 00	11 78	151 78
J. K. Howe	Expert computer	8	5 00 per day	40 00	....	40 00
M. F. Church	Expert computer	131	4 50 per day	589 50	....	589 50
John A. Giles	Expert computer	116	4 50 per day	522 00	....	522 00
C. V. Merrick	Expert computer	90	4 50 per day	405 00	....	405 00
F. W. Bristow	Expert computer	76	4 50 per day	342 00	....	342 00
E. Wolter	Expert computer	16	6 00 per day	96 00	....	96 00
D. B. Lobb	Expert computer	262	3 50 per day	917 00	....	917 00
C. T. Middlebrook	1st asst. engineer	87	6 00 per day	522 00	....	522 00
G. C. Mills	Assistant engineer	109	5 00 per day	545 00	243 14	788 14
Noble E. Whitford	Assistant engineer	130	5 00 per day	650 00	....	650 00
A. M. Evans	Assistant engineer	110	5 00 per day	550 00	225 09	775 09
Geo. D. Holmes	Assistant engineer	100	5 00 per day	500 00	98 23	598 23
Arthur O'Brien	Assistant engineer	29	5 00 per day	145 00	....	145 00
Seth Van Loan	Assistant engineer	111	5 00 per day	555 00	13 65	568 65
Foster H. Morse	Assistant engineer	19	5 00 per day	95 00	....	95 00
H. D. Alexander	Assistant engineer	120	5 00 per day	600 00	122 53	722 53
C. W. [illegible]	Assistant engineer	130	5 00 per day	650 00	....	650 00
John R. Knox	Assistant engineer	143	5 00 per day	715 00	166 82	881 82
I. E. Matthews	Assistant engineer	133	5 00 per day	665 00	....	665 00
H. C. Humphrey	Assistant engineer	135	5 00 per day	675 00	5 92	680 92
R. J. Marsher	Assistant engineer	90	5 00 per day	450 00	....	450 00
M. B. Farmer	Assistant engineer	111	5 00 per day	555 00	....	555 00
C. A. Poole	Draftsman	61	5 00 per day	305 00	....	305 00
John A. O'Connor	Draftsman	59	4 50 per day	265 50	....	265 50
E. C. Olcott	Draftsman	57	4 50 per day	256 50	....	256 50
George L. Schriber	Draftsman	20	4 50 per day	90 00	....	90 00
H. H. Bush	Draftsman	217	3 50 per day	759 50	19 22	778 72
L. Lemon Jr.	Draftsman	53	3 50 per day	185 50	....	185 50
C. C. Brockner Jr.	Draftsman	53	3 00 per day	159 00	....	159 00
Alexander Haring	Leveler	131	4 50 per day	589 50	75 50	665 00

Barge Canal Survey—Head Office Payments—(Continued).

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
H. G. White	Leveler	74	$4 50 per day	$333 00	$6 15	$339 15
G. S. Minnis	Leveler	37	4 50 per day	166 50	50 73	217 23
O. J. Dempster	Leveler	90	4 50 per day	405 00	....	405 00
S. L. Adcock	Leveler	74	4 50 per day	333 00	....	333 00
L. H. Ireland	Leveler	32	4 50 per day	144 00	....	144 00
W. H. Hyde	Leveler	74	4 50 per day	333 00	....	333 00
J. K. Browne	Leveler	74	4 50 per day	333 00	....	333 00
E. A. Lamb	Leveler	90	4 50 per day	405 00	....	405 00
C. E. Hopkins	Leveler	90	4 50 per day	405 00	....	405 00
B. E. Failing	Leveler	243	4 50 per day	1,093 50	....	1,093 50
P. A. Meyer	Leveler	108	4 50 per day	486 00	....	486 00
Clark Brown	Leveler	139	4 50 per day	625 50	....	625 50
J. B. Maguire	Leveler	90	4 50 per day	405 00	....	405 00
T. A. Hendrickson	Leveler	77	4 50 per day	346 50	64	347 14
A. Adams	Leveler	6	4 50 per day	27 00	....	27 00
G. D. Williams	Leveler	47	4 50 per day	211 50	162 16	373 66
George H. Penfield	Rodman	72	3 50 per day	252 00	....	252 00
G. W. Abbott	Rodman	108	3 50 per day	378 00	....	378 00
Gilbert Young	Rodman	90	3 50 per day	315 00	....	315 00
F. S. Hurlbut	Rodman	74	3 50 per day	259 00	....	259 00
A. H. Lawton	Rodman	74	3 50 per day	259 00	....	259 00
E. H. Stewart	Rodman	74	3 50 per day	259 00	....	259 00
W. H. Porter	Rodman	108	3 50 per day	378 00	....	378 00
D. A. Ketchum	Rodman	20	3 50 per day	70 00	8 22	78 22
Jesse C. Patrick	Rodman	56	3 50 per day	196 00	....	196 00
W. E. Conklin	Rodman	12	3 50 per day	42 00	....	42 00
M. W. Tuttle	Rodman	42	3 50 per day	147 00	....	147 00
L. C. Giltner	Rodman	20	3 50 per day	70 00	....	70 00
B. W. Rosekrans	Rodman	121	3 50 per day	423 50	....	423 50
W. J. Cunningham	Rodman	109	3 50 per day	381 50	....	381 50
C. H. McCulloch	Rodman	15	3 50 per day	52 50	....	52 50
E. J. Greiner	Chainman	9	2 50 per day	22 50	....	22 50
H. S. Schermerhorn	Chainman	53	2 50 per day	132 50	....	132 50
C. W. G. Costello	Chainman	74	2 50 per day	185 00	....	185 00
C. K. Munroe	Chainman	5	2 50 per day	12 50	....	12 50
Daniel D. Mead	Chainman	22	2 50 per day	55 00	28 86	83 86
E. S. Merritt	Chainman	35	2 50 per day	87 50	5 15	92 65
L. L. Melius	Chainman	72	3 00 per day	216 00	42 41	258 41
R. M. Eames	Chainman	14	3 00 per day	42 00	....	42 00
F. G. Tilton	Chainman	12	3 00 per day	36 00	54	36 54
James T. Brady	Chainman	56	2 50 per day	140 00	....	140 00
A. L. Reynolds	Chainman	90	2 50 per day	225 00	....	225 00
Frank Lutz	Chainman	291	2 50 per day	727 50	....	727 50
F. L. Fonda	Chainman	313	3 00 per day	939 00	....	939 00
J. J. Schmid	Chainman	60	2 50 per day	150 00	2 50	152 50
W. J. Keays	Chainman	74	2 50 per day	185 00	....	185 00
A. W. Peters	Chainman	74	3 00 per day	222 00	....	222 00
W. H. Hobday	Chainman	77	2 50 per day	192 50	....	192 50
F. G. Bartlett	Chainman	52	2 50 per day	130 00	....	130 00
F. E. Paddock	Chainman	72	2 50 per day	185 00	....	185 00
F. G. Moses	Chainman	75	2 50 per day	192 50	....	192 50
T. Beaupre	Chainman	60	2 50 per day	150 00	4 58	154 58
A. P. Mead, Jr	Chainman	94	3 00 per day	282 00	....	282 00
W. H. O'Brien	Chainman	95	2 50 per day	237 50	....	237 50
George McDonald	Chainman	219	3 00 per day	657 00	4 20	661 20
W. J. Valleau	Sec. consulting eng's.	288	2 00 per day	576 00	30 85	606 85
Thomas F. Kelly	Stenographer	....	75 00 per mo.	675 00	50	675 50
S. C. Reed	Stenographer	....	70 00 per mo.	81 29	6 60	87 89
Paul W. Buckley	Stenographer	....	70 00 per mo.	178 38	....	178 38
Bulah Carle	Stenographer	24	2 00 per day	48 00	....	48 00
Helen K. Sheehy	Stenographer	33	2 00 per day	66 00	....	66 00
Carrie M. Clancy	Stenographer	....	75 00 per mo.	65 32	....	65 32
D. B. LaDu	Laborer	53	2 00 per day	106 00	30 50	136 50
J. S. Nevins	Laborer	78	2 00 per day	156 00	30 50	186 50
James S. Cook	Laborer	80	2 00 per day	160 00	43 00	203 00
C. H. Fosdick	Laborer	133	2 00 per day	266 00	83 30	349 30
F. J. Topping	Laborer	13	2 00 per day	26 00	10 53	36 53
W. J. Murray	Laborer	12	2 00 per day	24 00	6 50	30 50
C. R. Hall	Laborer	4	2 00 per day	8 00	2 00	10 00
W. R. Purdy	Laborer	12	2 00 per day	24 00	6 50	30 50
S. J. Rees	Laborer	12	2 00 per day	24 00	6 50	30 50

Barge Canal Survey—Head Office Payments—(Continued).

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
H. C. Herron	Laborer	13	$2 00 per day	$26 00	$12 40	$38 40
A. F. Armstrong	Laborer	8	2 00 per day	16 00		16 00
M. G. Hilpert	Laborer	8	2 00 per day	16 00		16 00
C. W. Wilcox	Laborer	8	2 00 per day	16 00		16 00
W. E. Wilson	Laborer	8	2 00 per day	16 00		16 00
Cledge Potts	Laborer	8	2 00 per day	16 00		16 00
D. C. Cas	Laborer	16	2 00 per day	32 00		32 00
A. E. South	Laborer	13	2 00 per day	26 00		26 00
J. W. Spalding	Laborer	9	2 00 per day	18 00		18 00
J. H. Coleman	Laborer	7	2 00 per day	14 00		14 00
C. H. Kirby	Laborer	52	2 00 per day	104 00	27 50	131 50
Horace W. Hooker	Laborer	27	2 00 per day	54 00		54 00
William Hayes	Laborer	10	2 00 per day	20 00	6 00	26 00
James Hickey	Laborer	10	2 00 per day	20 00	6 00	26 00
Thomas Shea	Laborer	11	2 00 per day	22 00	6 50	28 50
Arthur C. Hess	Laborer	6	2 00 per day	12 00		12 00
Ezra G. Hollenbeck	Laborer	25	2 00 per day	50 00		50 00
Edward Hollenbeck	Laborer	52	2 00 per day	104 00		104 00
J. P. Seible	Laborer	20	2 00 per day	40 00	9 67	49 67
Henry Ivison	Laborer	43	2 00 per day	86 00	16 81	102 81
A. S. Kinney	Laborer	20	2 00 per day	40 00	10 43	50 43
R. J. Harding	Laborer	9	2 00 per day	18 00		18 00
Charles Seymour	Laborer	9	2 00 per day	18 00		18 00
J. J. Desmond	Laborer	81	2 00 per day	162 00	47 00	209 00
F. H. Burgess	Gauge reader		5 00 per mo.	30 00		30 00
William Hont	Gauge reader		3 00 per mo.	18 77		18 77
Charles B. Edick	Gauge reader		3 00 per mo.	18 29		18 29
John Brown	Gauge reader		3 00 per mo.	18 77		18 77
W. B. Bucklin	Gauge reader		3 00 per mo.	18 29		18 29
George McChesney	Gauge reader		3 00 per mo.	18 77		18 77
Fred Birch	Gauge reader		3 00 per mo.	18 19		18 19
E. Simkins	Gauge reader		3 00 per mo.	18 77		18 77
Louis Phillips	Gauge reader		5 00 per mo.	31 29		31 29
William Butler	Gauge reader		3 00 per mo.	18 87		18 87
L. S. Clute	Gauge reader		3 00 per mo.	18 87		18 87
H. R. Betts	Gauge reader		7 00 per mo.	49 00		49 00
James Devins	Gauge reader		5 00 per mo.	30 48		30 48
Herbert Ash	Gauge reader		5 00 per mo.	10 48		10 48
E. J. Nelson	Gauge reader		5 00 per mo.	35 00		35 00
J. H. Nickerson	Gauge reader		5 00 per mo.	19 03		19 03
Edward Cantors	Gauge reader		5 00 per mo.	5 00		5 00
						$84,137 67

Incidental Expenses.

Livery	$430 00	
Postage	40 58	
Fuel and light	253 08	
Office rent	365 00	
Telephone and telegraph	279 86	
Stationery, etc.	390 90	
Miscellaneous	2,607 25	
		4,467 41
Total		$88,605 11

NOTE.—Apportioned to the different divisions and canals as follows:

Eastern division, Erie canal, [illegible]	$30,981 53
Eastern division, Champlain canal, 3 [illegible]	2,430 26
Middle division, Erie canal, [illegible]	26,361 53
Middle division, Oswego canal, [illegible]	2,430 26
Western division, Erie canal, 30¼	26,361 53
Total	$88,605 11

Saranac Dam, Lock, Etc.

(Chap. 627, Laws 1898; chap. 417, Laws 1900; chap. 427, Laws 1900; chap. 638, Laws 1901.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total
Foster B. Morse	Assistant engineer	43	$5 00 per day	$215 00	$70 67	$285 67
Incidental Expenses.						
Livery					$3 00	
Telegraph and telephone					2 38	
Miscellaneous					39 00	
						44 38
Total						$330 05

Improvement Shinnecock Canal.

(Chapter 419, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
H. A. Van Alstyne	Resident engineer	....	$2,400 per yr.	$29 42	....	$29 42
John R. Kaley	Assistant engineer	123	5 00 per day	615 00	$8 68	623 68
Richard W. Barrett	Laborer	85	2 00 per day	170 00	4 83	174 83
C. R Nasmith	Laborer	9	2 00 per day	18 00	11 33	29 33
						$857 26
Incidental Expenses.						
Telegraph and telephone					$1 36	
Postage					1 11	
Livery					1 50	
Miscellaneous					37 72	
						41 69
Total						$898 95

Boundary Line Herkimer and Hamilton Counties.

(Chapter 439, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
C. H. Flanigan	Engineer in charge	45	$6 00 per day	$270 00	$366 00	$636 00
Dorlon Clark	Assistant engineer	26	5 00 per day	130 00	....	130 00
H. P. Willis	Leveler	62	4 50 per day	279 00	....	279 00
Chas. D. Burrus	Draftsman	26	5 00 per day	130 00	....	130 00
Jno. A. O'Connor	Draftsman	11	4 50 per day	49 50	....	49 50
C. H. MacCulloch	Rodman	12	3 50 per day	42 00	....	42 00
Parkes D. Wendell	Chainman	26	3 00 per day	78 00	....	78 00
W. J. Valleau	Financial clerk	15	5 00 per day	75 00	....	75 00
Irving J. Morris	Chief clerk	....	....	....	18 44	18 44
						$1,437 94
Incidental Expenses.						
Livery					$104 50	
Postage					1 00	
Telegraph and telephone					8 57	
Miscellaneous					320 26	
						434 33
Total						$1,872 27

Surveys Forest Preserve Board.

(Chapter 419, Laws 1900; chapter 645, Laws 1901.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
James R. McClintock	Laborer	193	$2 00 per day	$386 00	$22 16	$408 16
John R. Ash	Laborer	8	2 00 per day	16 00	....	16 00
William Farrell	Laborer	64	2 00 per day	128 00	....	128 00
Wilson Harger	Laborer	57	2 00 per day	114 00	....	114 00
C. P. McKillip	Laborer	6	2 00 per day	12 00	....	12 00
J. J. McCoy	Laborer	13	2 00 per day	26 00	....	26 00
Frank Ploof	Laborer	17	2 00 per day	34 00	....	34 00
W. H. Gillespie	Laborer	57	2 00 per day	114 00	....	114 00
E. G. Hollenbeck	Laborer	89	2 00 per day	178 00	....	178 00
A. S. Kinney	Laborer	36	2 00 per day	72 00	....	72 00
Frank T. Ostrander	Laborer	57	2 00 per day	114 00	....	114 00
A. S. Whitbeck	Laborer	57	2 00 per day	114 00	....	114 00
M. Putnam	Laborer	58	2 00 per day	116 00	....	116 00
John F. Smith	Laborer	21	2 00 per day	42 00	....	42 00
George E. Mulligan	Laborer	21	2 00 per day	42 00	....	42 00
J. Y. McClintock	Assistant engineer	....	....	....	309 71	309 71
						$1,839 87
Incidental Expenses.						
Livery					$128 50	
Postage					2 50	
Telegraph and telephone					50	
Miscellaneous					438 30	
						569 80
Total						$2,409 67

State Court of Claims.

(Chapter 419, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
T. C. Leutzè	Division engineer	....	....	... .	$264 21	$264 21
H. A. Van Alstyne	Resident engineer	....	$2,400 per yr.	$132 68	64 43	197 11
M. H. Ranney	Assistant engineer	184	5 00 per day	920 00	101 01	1,021 01
Foster B. Morss	Assistant engineer	52	5 00 per day	260 00	23 42	283 42
Dorlon Clark	Assistant engineer	37	5 00 per day	185 00	29 94	214 94
John R. Kaley	Assistant engineer	3	5 00 per day	15 00	14 56	29 56
Fred S. Strong	Leveler	104	4 50 per day	468 00	181 06	649 06
T. A. Hendrickson	Leveler	46	4 50 per day	207 00	47 84	254 84
H. P. Willis	Leveler	2	4 50 per day	9 00	3 06	12 06
Perry Filkin	Leveler	52	4 50 per day	234 00	16 95	250 95
F. M. Williams	Leveler	4	4 50 per day	18 00	9 32	27 32
H. W. DeGraff	Leveler	5	4 50 per day	22 50	20 11	42 61
John A. O'Connor	Draftsman	88	4 50 per day	396 00	85 78	481 78
L. W. Cottrell	Draftsman	3	3 50 per day	10 50	....	10 50
Nathan E. Young	Rodman	8	3 50 per day	28 00	11 19	39 19
Frank Roberts	Rodman	33	3 50 per day	115 50	53 08	168 58
C. H. MacCulloch	Rodman	15	3 50 per day	52 50	31 69	84 19
W. J. Gilmour	Rodman	5	3 50 per day	17 50	8 88	26 38
H. J. Richardson	Rodman	103	3 50 per day	360 50	26 53	387 03
Parkes D. Wendell	Chainman	33	3 00 per day	99 00	48 67	147 67
William Van Epps	Chainman	4	3 00 per day	12 00	6 95	18 95
W. B. Strong	Chainman	7	2 50 per day	17 50	15 55	33 05
Fred H. Owens	Chainman	20	2 50 per day	50 00	26 51	76 51
L. L. Melins	Chainman	14	3 00 per day	42 00	6 40	48 40
James T. Brady	Chainman	3	2 50 per day	7 50	5 10	12 60
F. G. Tilton	Chainman	1	2 50 per day	2 50	1 34	3 84
Carl McCormick	Laborer	61	2 00 per day	122 00	....	122 00
Talcott Dunbar	Laborer	55	2 00 per day	110 00	....	110 00
Charles Smith	Laborer	39	2 00 per day	78 00	....	78 00
James Dunbar	Laborer	62	2 00 per day	124 00	....	124 00
John F. Allen	Laborer	4	2 00 per day	8 00	....	8 00
Zeb Dupuy	Laborer	9	2 00 per day	18 00	....	18 00
C. M. Edwards	Laborer	12	2 00 per day	24 00	....	24 00
A. S. Kinney	Laborer	13	2 00 per day	26 00	18 85	44 85
Joseph Gregory	Laborer	12	2 00 per day	24 00	25 33	49 33
E. M. Reedy	Laborer	27	2 00 per day	54 00	....	54 00
Henry Shoemaker	Laborer	1	2 00 per day	2 00	1 34	3 34
Fred McDonald	Laborer	3	2 00 per day	6 00	....	6 00
A. Van Rensselaer	Laborer	7	2 00 per day	14 00	11 19	25 19
Edward F. Ball	Laborer	4	2 00 per day	8 00	....	8 00
						$5,460 47

Incidental Expenses.

Livery	$108 75	
Postage	6 00	
Telegraph and telephone	32 06	
Miscellaneous	685 95	
		832 76
Total		$6,293 23

Blue Line Maps, Erie, Oswego and Champlain Canals.

(Chapter 569, Laws 1899).

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
George L. Schillner	Draftsman	270	$4 50 per day	$1,215 00	....	$1,215 00
John A. O'Connor	Draftsman	15	4 50 per day	67 50	....	67 50
Total						$1,282 50

Examination, Monuments, Maps, Etc.

(Chapter 419, Laws 1900)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
C. H. Flanigan	Engineer in charge	164	$6 00 per day	$984 00	$401 22	$1,385 22
Arthur O'Brien	Assistant engineer	25	5 00 per day	125 00	114 62	239 62
A. M. Evans	Assistant engineer	36	5 00 per day	180 00	....	180 00
L. G. Fenton	Leveler	25	4 50 per day	112 50	8 26	120 76
Lewis B. Jones	Leveler	14	4 50 per day	63 00	....	63 00
Chas. D Burrus	Draftsman	10	5 00 per day	50 00	....	50 00
Geo. L. Schillner	Draftsman	25	4 50 per day	112 50	....	112 50
L. K. Devendorf	Rodman	12	3 50 per day	42 00	78 22	120 22
R. T. Webster	Rodman	31	3 50 per day	108 50	....	108 50
B. G. Priest	Laborer	29	2 00 per day	58 00	....	58 00
Edward Hollenbeck	Laborer	27	2 00 per day	54 00	....	54 00
Edward A. Bond	State engineer	....	....	....	221 48	221 48
W. J. Valleau	Financial clerk	....	....	....	102 67	102 67
M. Peckham	Land clerk	....	....	....	8 30	8 30
J. Smelzer	Clerk	....	....	....	8 00	8 00
I. J. Morris	Chief clerk	....	....	....	11 70	11 70
						$2,843 97
Incidental Expenses.						
Livery					$108 88	
Telegraph and telephone					15 76	
Stationery and printing					28 00	
Miscellaneous					330 82	
						483 46
Total						$3,327 43

Topographic Survey—State of New York.

(Chapter 386, Laws 1900; chapter 645, Laws 1901.)

Allen, A. E.	$20 50
Anderson, John, Jr.	242 53
Avakian, John C.	74 19
Aldons, Wm.	45 00
Anderson, M.	51 50
Bumstead, Albert	741 25
Bassett, C. C.	284 46
Bennett, A. K.	124 00
Bartlett, F. G.	12 83
Bradley, J. J.	44 03
Buffington, C. A.	23 50
Banker, J. W.	34 00
Brown, Albert	78 20
Burnham, M. S.	180 00
Bosworth, Frank	110 00
Brice, Leslie	100 00
Bolles, E. R.	14 00
Bassinger, T. G.	244 96
Baldwin, David H.	207 21
Cullen, James B.	60 00
Cline, R. L.	265 00
Clark, W. C.	240 00
Crossman, R. W.	440 78
Cutter, S. H.	11 25
Dimmick, O.	16 00
Dukett, W. W.	43 80
Daniel, Milo B.	110 00
Dubus, Peter	50 00
Evans, C. P., Jr.	130 00
Easman, A. J.	41 50
Fields, H.	20 00
Fitch, Francis T.	212 17
Fernow, B. E.	195 00
Fowler, A. T.	152 00
Frost, A. B.	23 33
Greene, W. E.	431 17
Gayetty, J. I.	254 50
Gilbert, Arch. M.	30 00
Gilbert, Warren W.	400 88
Griffin & Hoxie	170 26
Goodbred, P.	40 00
Gold, L. E.	85 21
Guerdrun, Geo. H.	354 63
Graff, Fred, Jr.	20 00
Havens, A. S.	30 00
Harrison, R. L.	91 21
Hoopes, Chas. L.	353 89
Hodges, John W.	106 21
Hill, J. J.	104 48
Hunter, David	338 65
Hays, Anna M.	60 00
Hendrick, E. D.	30 00
Hulsapple, Eustace	30 00
Hackett, George	100 00
Hill, J. E. B.	145 74
Hallock, Chas. A.	102 37
Hamilton, E. G.	18 85
Ingram, E. L.	45 42
Jennings, J. H.	3,114 81
Jones, Oscar	270 91
Jolicoeur, David	80 00
Keough, M. J., & Bro.	41 20
Kelly, Wm.	368 14
Leiders, O. F.	39 00
Lovel, W. H.	30 55
Lush, W. G.	51 93
McNair, E. L.	1,184 58
Mallory, F. L.	220 00
Murphy, W. P.	37 50
Morey, W. H. S.	200 00
Meade, A. P., Jr.	153 00
Miller, Dwight	12 50
McMorris, S. A.	20 13
McArthur, John	50 00
Olin, J. Day	134 00
Ott, William	31 50
Paige, H. B.	342 58
Powers, Harry W.	175 00
Place, T. K.	80 75

Parr Br[illegible]	$[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible] E. M.	[illegible]
[illegible] M. L.	[illegible]
[illegible]	[illegible]
[illegible] A. [illegible]	[illegible]
[illegible] E. F. [illegible]	[illegible]
[illegible] C. H.	[illegible]
[illegible]	[illegible]
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[illegible]	[illegible]
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[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible] & [illegible]	[illegible]
[illegible] Jr.	[illegible]
W[illegible] H. M.	[illegible]
Ward, [illegible]	[illegible]
Ward & [illegible]	[illegible]
Warren, Frank H.	45 00
W[illegible]	[illegible]
W[illegible]	[illegible]
Young, G[illegible]	[illegible] 00
Total	$22,1[illegible] 04

Hydrography.

(Measurement of flow of stream.)

(Chapter 420, Laws 1909; Chapter 645, Laws 1901.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Robert E. Horton	Hydrographer U. S. G. S.					$1,833 81
M. T. Riley	Assistant					139 57
John D. Luther	Assistant					122 44
Total						$2,095 82

Improvement Public Highways.

(Chapter 115, Laws 1898.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
T. C. Leutzè	Division engineer	....	....	....	$135 45	$135 45
H. A. Van Alstyne	Resident engineer	....	$2,400 per yr.	$474 55	442 59	917 14
E. A. Bond	State Engineer	....	....	....	32 20	32 20
Wm. Pierson Judson	Deputy State Eng'r	....	....	....	17 65	17 65
William B. Landreth	Special resident eng'r	....	....	....	36 18	36 18
C. H. Flanigan	Engineer in charge	122	6 00 per day	732 00	235 67	967 67
Reeves Smith	First assistant eng'r	7	6 00 per day	42 00	....	42 00
Noble E. Whitford	Assistant engineer	92	5 00 per day	460 00	137 57	597 57
C. W. Trumbull	Assistant engineer	23	5 00 per day	140 00	1 38	141 38
M. B. Palmer	Assistant engineer	21	5 00 per day	105 00	13 64	118 64
R. J. Marcher	Assistant engineer	46	5 00 per day	230 00	12 39	242 39
Foster B. Morse	Assistant engineer	212	5 00 per day	1,060 00	16 90	1,076 90
M. H. Ranney	Assistant engineer	39	5 00 per day	195 00	18 68	213 68
A. M. Evans	Assistant engineer	69	5 00 per day	345 00	4 76	349 76
F. S. Strong	Leveler	131	4 50 per day	589 50	143 09	732 59
James K. Browne	Leveler	25	4 50 per day	112 50	32 03	144 53
H. W. DeGraff	Leveler	324	4 50 per day	1,458 00	304 96	1,762 96
Ralph Russell	Leveler	184	4 50 per day	828 00	206 65	1,034 65
George H. Penfield	Leveler	52	4 50 per day	234 00	9 09	243 09
E. C. Clark	Leveler	21	4 50 per day	94 50	21 98	116 48
Clark Brown	Leveler	36	4 50 per day	162 00	16 09	178 09
George A. Ensign	Leveler	93	4 50 per day	418 50	38 23	456 73
L. G. Fenton	Leveler	68	4 50 per day	306 00	54 45	360 45
Perry Filkin	Leveler	248	4 50 per day	1,116 00	23 48	1,139 48
F. N. Sanders	Leveler	195	4 50 per day	877 50	210 06	1,087 56
O. J. Dempster	Leveler	97	4 50 per day	436 50	3 88	440 38
H. P. Willis	Leveler	215	4 50 per day	967 50	57 36	1,024 86
T. A. Hendrickson	Leveler	176	4 50 per day	792 00	90	792 90
F. M. Williams	Leveler	167	4 50 per day	751 50	96 73	848 23
John A. O'Connor	Draftsman	109	4 50 per day	490 50	6 18	496 68
H. H. Bush	Draftsman	104	3 50 per day	364 00	3 23	367 23
L. W. Cottrell	Draftsman	57	3 50 per day	199 50	2 10	201 60
Frank Roberts	Rodman	274	3 50 per day	959 00	153 65	1,112 65
C. H. MacCulloch	Rodman	278	3 50 per day	973 00	64 61	1,037 61
F. M. Williams	Rodman	135	3 50 per day	472 50	181 06	653 56
W. J. Gilmour	Rodman	170	3 50 per day	595 00	71 70	666 70
Jesse C. Patrick	Rodman	109	3 50 per day	381 50	10 92	392 42
C. M. Pepson	Rodman	53	3 50 per day	185 50	....	185 50
George H. Penfield	Rodman	56	3 50 per day	196 00	34 73	230 73
H. J. Richardson	Rodman	2	3 50 per day	7 00	32 78	39 78
Nathan E. Young	Rodman	19	3 50 per day	66 50	....	66 50
W. E. Conklin	Rodman	91	3 50 per day	318 50	124 48	442 98
Parkes D. Wendell	Chainman	41	3 00 per day	123 00	64 53	187 53
L. L. Melius	Chainman	131	3 00 per day	393 00	34 82	427 82
E. S. Merritt	Chainman	15	3 00 per day	45 00	....	45 00
William Van Epps	Chainman	174	3 00 per day	522 00	106 66	628 66
H. S. Miller	Chainman	119	2 50 per day	297 50	....	297 50
H. S. Miller	Chainman	59	3 00 per day	177 00	....	177 00
H. C. Titus	Chainman	216	2 50 per day	540 00	11 81	551 81
H. C. Titus	Chainman	13	3 00 per day	39 00	....	39 00
James T. Brady	Chainman	109	2 50 per day	272 50	36 77	309 27
Fred H. Owens	Chainman	159	2 50 per day	397 50	97 53	495 03
W. B. Strong	Chainman	212	2 50 per day	530 00	19 72	549 72
Frank Kromer	Chainman	140	2 50 per day	350 00	185 82	535 82
Fred G. Tilton	Chainman	125	2 50 per day	312 50	36 02	348 52
Frank Lutz	Chainman	25	2 50 per day	62 50	34 02	96 52
Lewis Fisher	Chainman	56	2 50 per day	140 00	....	140 00
H. A. Knapp	Chainman	33	2 50 per day	82 50	14 08	96 58
H. A. Knapp	Chainman	36	3 00 per day	108 00	....	108 00
Roscoe R. Mitchell	Laborer	5	2 00 per day	10 00	....	10 00
John W. Sage	Laborer	32	2 00 per day	64 00	46 03	110 03
Henry S. Wells	Laborer	15	2 00 per day	30 00	12 83	42 83
Eltinge Breed	Laborer	10	2 00 per day	20 00	....	20 00
E. H. Butler	Laborer	17	2 00 per day	34 00	2 30	36 30
John Y. Shepard	Laborer	12	2 00 per day	24 00	....	24 00
Edward F. Ball	Laborer	4	2 00 per day	8 00		8 00
A. S. Kinney	Laborer	110	2 00 per day	220 00	136 28	356 28
Joseph Gregory	Laborer	109	2 00 per day	218 00	167 89	385 89
W. M. Payne	Laborer	220	2 00 per day	440 00	212 89	652 89
Harry Bowen	Laborer	211	2 00 per day	422 00	316 29	738 29

Improvement Public Highways—(Concluded).

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
David Irwin	Laborer	48	$2 00 per day	$96 00	....	$96 00
Harry Poole	Laborer	150	2 00 per day	300 00	$50 68	350 68
Phillip Hamilton	Laborer	145	2 00 per day	290 00	3 62	293 62
C. R. Nasmith	Laborer	96	2 00 per day	192 00	7 84	199 84
A. G. Getman	Laborer	80	2 00 per day	160 00	....	160 00
Henry Ivison	Laborer	223	2 00 per day	446 00	163 60	609 60
John D. Fish	Laborer	51	2 00 per day	102 00	....	102 00
Charles W. Dutcher	Laborer	111	2 00 per day	222 00	....	222 00
John McCabe	Laborer	51	2 00 per day	102 00	....	102 00
Ambrose Van Tassel	Laborer	124	2 00 per day	248 00	....	248 00
Arthur McNab	Laborer	44	2 00 per day	88 00	....	88 00
Ezra P. Hillson	Laborer	42	2 00 per day	84 00	....	84 00
L. L. Luther	Laborer	82	2 00 per day	164 00	13 79	177 79
Walter K. Ward	Laborer	66	2 00 per day	132 00	4 90	136 90
Fred McDonald	Laborer	130	2 00 per day	260 00	4 40	264 40
E. A. Bonney	Laborer	61	2 00 per day	122 00	....	122 00
Herbert S. Wells	Laborer	71	2 00 per day	142 00	....	142 00
Lawrence R. Ellis	Laborer	60	2 00 per day	120 00	86 85	206 85
Porter L. Merriman	Laborer	49	2 00 per day	98 00	58 55	156 55
Edward Hollenbeck	Laborer	39	2 00 per day	78 00	10 82	88 82
A. W. Rogers	Laborer	66	2 00 per day	132 00	6 93	138 92
E. S. Van Dyke	Laborer	88	2 00 per day	176 00	....	176 00
C. M. Brooks	Laborer	70	2 00 per day	140 00	....	140 00
F. McEwan Pruyn	Laborer	95	2 00 per day	190 00	6 56	196 56
E. C. Likely	Laborer	57	2 00 per day	114 00	....	114 00
A. Van Rensselaer	Laborer	38	2 00 per day	76 00	....	76 00
J. L. Sweet	Laborer	62	2 00 per day	124 00	11 98	135 98
B. G. Priest	Laborer	64	2 00 per day	128 00	2 10	130 10
Geo. Conover	Laborer	59	2 00 per day	118 00	....	118 00
D. V. Ashley	Laborer	38	2 00 per day	76 00	18 55	94 55
Henry Shoemaker	Laborer	65	2 00 per day	130 00	1 83	131 83
Henry Throop	Laborer	60	2 00 per day	120 00	6 64	126 64
Lewis L. Crozier	Laborer	89	2 00 per day	178 00	6 64	184 64
C. H. Fosdick	Laborer	84	2 00 per day	168 00	3 41	171 41
Charles R. Cornwall	Laborer	54	2 00 per day	108 00	....	108 00
William Riley	Laborer	151	2 00 per day	302 00	....	302 00
Earl S. Crannell	Laborer	44	2 00 per day	88 00	70 84	158 84
Reuben Peckham	Laborer	42	2 00 per day	84 00	9 46	93 46
William Howitt	Laborer	46	2 00 per day	92 00	....	92 00
E. V. Mullineaux	Laborer	37	2 00 per day	74 00	8 18	82 18
George L. Blanvelt	Laborer	46	2 00 per day	92 00	9 03	101 03
Mortimer S. Cole	Laborer	48	2 00 per day	96 00	8 18	104 18
Seward A. Clark	Laborer	44	2 00 per day	88 00	4 35	92 35
F. A. Bedell	Laborer	35	2 00 per day	70 00	....	70 00
						$35,553 55

Incidental Expenses.

Livery	$2,236 20	
Postage	23 33	
Telegraph and telephone	113 83	
Stationery and printing	29 58	
Miscellaneous	807 55	
		3,210 49
Total		$38,764 04

Apron to Dam at Pine Kill.

(Chapter 621, Laws 1898; Chapter 388, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
H. A. Van Alstyne	Resident engineer	....	$2,400 per yr.	$51 60	....	$51 60
Dorlan Clark	Assistant engineer	11	5 00 per day	55 00	....	55 00
Total						$106 60

Old Field Notes, Maps, Etc.

(Chapter 569, Laws 1899; Chapter 645, Laws 1901).

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Parkes D. Wendell	Chainman	192	$3 00 per day	$576 00	$2 30	$578 30

The foregoing tables are summarized as follows:

Ordinary Repairs of Canals.

1	Erie Canal, chapter 570, Laws of 1899; chapter 418, Laws of 1900	$8,694 56
2	Champlain Canal, chapter 570, Laws of 1899; chapter 418, Laws of 1900	4,355 61

Extraordinary Repairs of Canals.

3	Erie Canal, chapter 208, Laws of 1899	124 56
4	Erie Canal, waste-weir No. 8, chapter 311, Laws of 1900	68 29
5	Erie Canal, bridge, town of Minden, chapter 596, Laws of 1899; chapter 457, Laws of 1900	540 86
6	Erie Canal, bridge, Twenty-third street, Watervliet, chapter 440, Laws of 1900	1,150 00
7	Champlain Canal, chapter 208, Laws of 1899	70 00
8	Champlain Canal, Searles waste-weir No. 9, chapter 311, Laws of 1900	1,059 72
9	Champlain Canal, aqueduct No. 3, chapter 311, Laws of 1900	787 37
10	Champlain Canal, repairing vertical walls, Section 2, chapter 311, Laws of 1900	130 00
11	Champlain Canal, vertical wall, Glens Falls feeder, chapter 438, Laws of 1900	345 50
12	Champlain Canal, bridge, Waterford, chapter 629, Laws of 1898; chapter 219, Laws of 1899; chapter 443, Laws of 1900	1,032 60

Barge Canal Survey.

13	Canal Survey, Erie Canal, chapter 411, Laws of 1900	$566 59
14	Canal Survey, head office payments, chapter 411, Laws of 1900	68,605 11

Special Work.

15	Saranac dam and lock, chapter 627, Laws of 1898; chapter 417, Laws of 1900; chapter 4[illegible], Laws of 1900; chapter 688, Laws of 1901	330 06
16	Improving Shinnecock Canal, chapter 419, Laws of 1900	898 95

Special Surveys, Etc.

17	Boundary line, Herkimer and Hamilton counties, chapter 429, Laws of 1900	1,572 27
18	Surveys, Forest Preserve Board, chapter 415, Laws of 1900; chapter 645, Laws of [illegible]	2,4[illegible] 57
[illegible]	Surveys, State Court of Claims, chapter 413, Laws of 190[illegible]	[illegible] 23
[illegible]	[illegible] Oswego and Champlain Canals, chapter 569, Laws of [illegible]	1,[illegible] 50
[illegible]	[illegible] monuments, maps, etc., chapter 569, Laws of 1899; chapter [illegible], Laws of [illegible]	[illegible]
[illegible]	[illegible] chapter [illegible], Laws of [illegible]; chapter [illegible], Laws of 190[illegible]	[illegible]
[illegible]	[illegible] Laws of [illegible]; chapter [illegible], Laws of 190[illegible]	[illegible]
[illegible]	[illegible] Laws of [illegible]	[illegible]
[illegible]	[illegible] Laws of [illegible]; chapter [illegible], Laws of [illegible]	[illegible]
[illegible]	[illegible] maps, etc., chapter [illegible], Laws of [illegible]; chapter [illegible], Laws of [illegible]	[illegible]
	Total	$[illegible]

Table of Contracts on Eastern Division Completed During the Year Ending September 30, 1901.

ERIE CANAL.

NAME OF CONTRACTOR.	Date of contract.	Character of work.	Appropriation.	Legislative Act. Chapter.	Legislative Act. Year.	Engineer's estimate at contract prices	Final estimate.
Joseph H. Conners	July 18, 1900	For completing the Saranac dam and constructing a lock at the end of said dam and providing a channel approach	$10,000 00 6,000 00 2,000 00	677 417 427 688	1898 1900 1900 1901	$7,488 60	$8,022 44
Owego Bridge Co.	Oct. 11, 1900	For constructing a bridge over the Erie canal opposite the village of St. Johnsville in the town of Minden, Montgomery county	6,500 00 3,000 00	596 457	1899 1900	7,180 00	7,254 67
Owego Bridge Co	Dec. 6, 1900	For ti at	15,000 00	440	1900	13,147 00	13,536 93
W. A. Burnham	Oct. 29, 1900	For p	10,000 00	438	1900	6,969 00	7,578 05
Reardon and Burnham	Nov. 21, 1900	For Fort Miller, N. Y	350,000 00	311	1900	5,189 50	6,749 06
C. W. Higley and Lewis T. Barber	Dec. 28, 1900	For rebuilding Searle's waste-weir No. 9 on the Champlain canal about 1.7 miles north of Wilbure Basin Road bridge Saratoga county, N. Y	350,000 00	311	1900	9,831 34	10,934 84
George A. Rogers	July 21, 1899	Impro For improving 1.03 road No. 11 town of North	180,000 00	115	1898	7,967 50	8,377 55
Donovan Bros	May 14, 1900	For improving 5.66 miles of the Ulster and Delaware turnpike road No. 16 town of Shandaken, Ulster county	150,000 00	115	1898	24,373 06	27,040 48

Table of Contracts Pending on the Eastern Division September 30, 1901.

ERIE CANAL.

Name of contractor.	Date of contract.	Character of work.	Appropriation.	Legislative Act. Chapter.	Legislative Act. Year.	Engineer's preliminary estimate.	Engineer's estimate at contract prices.	Payments to date.
[illegible]	May [illegible], 1901	For constructing a swing bridge over the Champlain canal [illegible] in the town of Waterford, Saratoga county, N. Y.	$6,000 00 2,000 00 5,000 00	629 219 443	1898 1899 1900	$10,320 50	$10,150 00	$7,021 00
[illegible]	May 1, 1901	For improving the [illegible] creek and Peconic canal	20,000 00	419	1900	12,420 00	11,710 00	4,539 00
[illegible]	July 14, 1901	For removing a channel approach to the lower entrance of the lock in the dam across the [illegible] river recently built by Joseph H. [illegible]	2,000 00	668	1901	600 00	600 00	408 00
		Improvement of Public Highways.						
[illegible]	May 17, 1900	For improving 1.64 miles of the Delaware Turnpike road No. 7, town of Bethlehem, Albany county	150,000 00	115	1898	12,256 00	11,396 44	11,818 33
[illegible]	May 8, 1900	For improving 1.11 miles of the Frankfort and Utica road No. 14, town of Frankfort, Herkimer county	150,000 00	115	1898	7,942 00	6,899 00	4,035 92
[illegible]	July 18, 1901	For completing the improvement of 0.5 miles of the Hastings Ardsley road No. 11, town of Greenburg, Westchester county	150,000 00	115	1898	....	500 00	475 00
[illegible]	July 18, 1901	For completing the improvement of of 3.08 miles of the Ardsley Elmsford road No. 18, town of Greenburg, Westchester county	150,000 00	115	1898	....	18,500 00	5,272 50
[illegible]	July 24, 1900	For improving [illegible] miles of the Mamaroneck White Plains road No. 19, town of Scarsdale, Westchester county	150,000 00	115	1898	29,222 00	23,160 00	17,324 55
[illegible]	Sept. 11, 1901	For completing the improvement of 8.77 miles of the White Plains Armonk road No. 20, town of North Castle, Westchester county	150,000 00	115	1898	....	12,767 62	8,043 60
Thomas H. Hart	June [illegible], 1900	For improving 8.41 miles of the Loudon road, No. [illegible], town of Colonie, Albany county	150,000 00	115	1898	35,508 00	27,400 00	28,170 87
Thomas H. Hart	July 10, 1901	For improving [illegible] miles of the Troy and Brunswick (Sec. 2) road No. 20, town of Brunswick, Rensselaer county	150,000 00	115	1898	28,820 00	24,840 00	....
The town board of the town of North Greenbush	June 20, 1901	For improving 2.59 miles of the Troy and Greenbush (Sec. 2) road No. 26, town of North Greenbush, Rensselaer county	150,000 00	115	1898	25,319 00	19,430 20	8,205 98

The town board of the town of Shandaken	June 10, 1901	…e Ulster and Dela-…d No. 31, town of…	150,000 00	115	1898	41,728 00	34,494 00	11,491 53
Snell Bros	June 5, 1901	…he Amsterdam and …of Florida, Mont-…	150,000 00	115	1898	17,510 00	15,800 16	5,834 11
John R. Briggs	June 5, 1901	…Gloversville-May-…hnstown and May-…	150,000 00	115	1898	33,720 00	27,456 00	3,682 33
McCabe & Duffy	May 31, 1901	…Ardsley-Elmsford …of Greenburg and …nty	150,000 00	115	1898	31,838 00	18,840 00	11,078 90
Eldert & Johanknecht	July 22, 1901	…White Plains-Ar-…35, town of North … county	150,000 00	115	1898	27,028 00	22,800 00	4,104 08
Town Board of the Town of Middletown	June 18, 1901	For improving 1.57 miles of the Griffins Corners road No. 36, Town of Middletown, Delaware co.	150,000 00	115	1898	6,160 00	5,350 20	1,290 43
Edgar Snyder & Co	June 10, 1901	For improving 4.00 miles of the Saugerties-Woodstock (Section 1) road No. 37, town of Woodstock, Ulster county	150,000 00	115	1898	22,010 00	19,910 00	6,868 95
R. & J. R. Martin	July 27, 1901	For improving 1.51 miles of the Waterford-Mechanicville (Section 1) road No. 39, town of Waterford, Saratoga county	150,000 00	115	[illegible]	11,970 00	10,500 00	2,728 50
Callanan Road Improvement Co	June 5, 1901	For improving 3.74 miles of the Delaware Turnpike (sec. 2) road No. 41, town of Bethlehem, Albany county	150,000 00	115	1898	23,497 20	20,269 00	5,774 10
Board of Supervisors of Orange County	June 18, 1901	For improving 11.00 miles of the Newburg-Woodbury road No. 42, towns of New Windsor, Cornwall and Woodbury, Orange county	150,000 00	115	1898	29,330 00	20,247 20	4,555 62
Board of Supervisors of Orange County	June 18, 1901	For improving 7.55 miles of the Cochecton Turnpike road No. 43, towns of Newburg and Montgomery, Orange county	150,000 00	115	1898	23,928 00	20,780 80	3,062 54
Board of Supervisors of Orange County	June 18, 1901	For improving 4.22 miles of the Goshen Florida road No. 44, towns of Goshen and Warwick, Orange county	150,000 00	115	1898	9,690 00	8,757 [illegible]	…………
Board of Supervisors of Orange County	June 18, 1901	For improving 9.25 miles of the Middletown Pine Bush road No. 45, towns of Crawford and Walkill, Orange county	150,000 00	115	1898	13,770 00	12,467 80	2,524 73
Board of Supervisors of Orange County	June 18, 1901	For improving 1.50 miles of the Turners Monroe road No. 46, town of Monroe, Orange county	150,000 00	115	1898	3,320 00	2,984 40	…………

Table of Contracts Pending on the Eastern Division September 30, 1901—(Continued).

ERIE CANAL.

NAME OF CONTRACTOR.	Date of contract.	Character of work.	Appropriation.	Legislative Act — Chapter.	Legislative Act — Year.	Engineer's preliminary estimate.	Engineer's estimate at contract prices.	Payments to date.
Eldert & Johanknecht ...	July 22, 1901	Fo r (	$150,000 00	115	1898	$37,562 00	$34,200 00	$760 50
Bellow & Merrit Co	July 24, 1901	Fo r	150,000 00	115	1898	44,084 00	40,814 77	3,023 61
McCabe & Duffy	May 31, 1901	Fo Corners road No. 52, town of Mt. Pleasant, West chester county	150,000 00	115	1898	31,411 00	28,870 00	2,015 25
McCabe & Duffy	May 31, 1901	For improving 1.76 miles of the McKeel's Corners Briar Cliff Manor road No. 53, towns of Ossining and Mt Pleasant, Westchester county..........	150,000 00	115	1898	13,068 00	12,644 00	....
McCabe & Duffy.	July 17, 1901.	For improving 2.03 miles of the Briar Cliff, Manor and Echo Lake road No. 54, towns of Ossining and New Castle, Westchester county.....	150,000 00	115	1898	22,540 00	20,100 00	... .
Thomas H. Karr.	July 10, 1901.	For improving 3.15 miles of the Hoag's Corners, Troy Turnpike road No. 55, town of Nassau Rensselaer county	150,000 00	115	1898	10,684 00	9,450 00	3,331 18
Prescott and Buckley Construction Company	June 7, 1901	For improving 2.62 miles of the Plattsburg-Keeseville (Sec 1) road, No. 56, town of Plattsburg, Clinton county	150,000 00	115	1898	16,910 00	16,900 00	7,098 00
Prescott and Buckley Construction Company	June 7, 1901	For improving 1.00 miles of the Windsor road, (Sec 1) No. 57, town of Champlain, Clinton county....	150,000 00	115	1898	7,780 00	6,800 00	....
Reardon and Burnham	June 4, 1901	For improving 6.06 miles of the Saratoga, Glens Falls road, No 58, town of Moreau, Saratoga county	150,000 00	115	1898	34,610 00	31,000 00	10,085 00
E. & J. E. Martin..........	July 27, 1901.	For improving 5.03 miles of the Waterford, Mechanicville (Sec. 2) road No. 59, town of Half Moon, Saratoga county.............	150,000 00	115	1898	36,532 00	32,900 00	....

REPORT

OF THE

DIVISION ENGINEER

OF THE

MIDDLE DIVISION

New York State Canals

For the Fiscal Year Ending September 30, 1901.

MIDDLE DIVISION.

Division Engineer's Office,
Syracuse, N. Y., *October* 1, 1901.

Hon. Edward A. Bond, *State Engineer and Surveyor, Albany, N. Y.:*

Dear Sir.—I respectfully herewith submit the annual report of the Division Engineer of the Middle Division of New York State canals for the fiscal year ending September 30, 1901.

The Middle Division comprises the following counties for all purposes except for constructing roads under chapter 115, Laws of 1898, to wit: Jefferson, Lewis, Oneida, Madison, Chenango, Broome, Tioga, Tompkins, Seneca, Yates, Ontario, Cayuga, Cortland, Onondaga and Oswego.

For purpose of constructing roads under chapter 115 Laws of 1898, the Middle Division comprises the counties above named except Yates and Ontario. St. Lawrence county is attached to Middle Division for convenience of access from the Division offices.

Tables hereto attached exhibit information required to be embodied in your annual report to the Legislature.

Table No. 1, hereto annexed, shows the names of the engineers duly appointed by the State Engineer and Surveyor, time employed, rate of compensation, and amount paid during the year, with the amount of other miscellaneous expenditures, for ordinary repairs, extraordinary repairs, improvement of public highways, special appropriations and special surveys.

Table No. 2 exhibits contracts in force under special appropriations at the close of the fiscal year, together with engineer's preliminary estimate of cost, engineer's estimate at contract

prices, and payments to September 30, 1901, for each piece of work and amount paid thereon.

Table No. 3 exhibits contracts under special appropriations, completed and settled during the fiscal year, showing appropriation, engineer's estimate at contract prices, and final account.

Table No. 4 exhibits contracts for the improvement of public highways in force, showing engineer's preliminary estimate, engineer's estimate at contract prices, and payment to September 30, 1901.

Table No. 5 exhibits statement of contracts for the improvement of public highways completed and settled during the fiscal year, engineer's preliminary estimate, engineer's estimate at contract prices, and final account.

Table No. 6 exhibits water record of Cayuga and Cross lakes and Seneca River, taken tri-annually.

NAVIGATION.

Navigation during the fiscal year has been interrupted but once from break in the canal, which occurred November 26, 1900; commenced refilling the long level on December first and completed filling December fourth. This break occurred so near the close of navigation that no large number of boats moving east was delayed, and those succeeded in reaching their destination before the final closing of the canal.

ORDINARY REPAIRS.

This department in accordance with provisions of chapter 338, Laws of 1894, is always subject to call from the Superintendent of Public Works "whenever the services of an engineer are required upon any portion of the canals undergoing repairs, or upon any construction or improvement work." The work performed by this department under ordinary repairs in compliance with statute is very important and quite extensive but cannot appear in this report, being of such diversified nature a recapitulation here would cover too much space to be of any practical value.

EXTRAORDINARY REPAIRS.

Under the above head is classed all work done under special laws, whether by the forces of the Superintendent of Public Works or by contract.

The following is a brief description of work performed under contract, under the immediate supervision of this department during the fiscal year. (See Table No. 2. Contracts in force.)

GUARD LOCK AND GATES AT SENECA LAKE OUTLET.

John R. Y. Cragie and Stephen Maggio, contractors.

Act, chapter 680, Laws of 1900.

Appropriation, $97,000.

This act provides "for building a guard lock with retaining works and waste-wiers, in Cayuga and Seneca canal and Seneca river, for the purpose of maintaining and regulating the waters of Seneca lake." Work was let September 12, 1900. Amount of bid $66,573. For description of the structure, see my report of last year. Owing to the failure of the contractors to properly proceed with the work, the sureties took possession and are prosecuting the work through Messrs. Bradley & Company of Fulton, N. Y.

At the close of the fiscal year the guard lock is substantially completed, leaving to be constructed the retaining works and the southwest abutment.

Anticipating possible claims for damages to property above the guard lock and around Seneca lake, levels have been taken daily above, at, and below the guard lock at fixed points to determine the effect of coffer dams upon the surface of the river and lake. These records will be authenticated and preserved for future reference in case the State has to defend claims for damages. These levels should be continued certainly weekly, for at least one year after the work is completed and coffer dams removed.

BRIDGE OVER SENECA RIVER, NEAR RUMSEY STREET, SENECA FALLS, N. Y.

American Bridge Company, contractors.

Act, chapter 224, Laws of 1898.

Act, chapter 398, Laws of 1900.

Appropriation $8,000.

Work was let August 28, 1900.

Amount of bid, $6,684.

This work was described in my report of last year. The substructure is complete, and the superstructure is in process of erection, and will without doubt be completed by December 1, next.

LIFT BRIDGE AT SCHUYLER STREET, UTICA, N. Y.

Havana Bridge Works, contractors.

Act, chapter 427, Laws of 1898.

Act, chapter 417, Laws of 1900.

Appropriation, $18,000.

This bridge is constructed on line of Schuyler street, in the city of Utica, directly over lock No. 46, to take place of a swing bridge just above the lock.

The work is substantially completed, and final account will soon be rendered.

LIFT BRIDGE AT CATHERINE AND ALMOND STREETS, SYRACUSE, N. Y.

Havana Bridge Works, contractors.

Act, chapter 424, Laws of 1898.

Act, chapter 547, Laws of 1900.

Appropriation by State, $11,500; a like sum appropriated by the city of Syracuse.

This structure is erected in place of an overhead Whipple cast iron truss bridge, which had approaches too steep for practical use, and is nearly completed.

LIFT BRIDGE AT WASHINGTON STREET, UTICA, N. Y.

Havana Bridge Works, contractors.

Act, chapter 397, Laws of 1898.

Act, chapter 402, Laws of 1900.

Act, chapter 537, Laws of 1900.

Appropriation, $18,000 by the State and $5,000, by the city of Utica. This structure is erected in place of a Whipple cast iron arch truss bridge, which had outworn its safety and usefulness.

A final account will soon be rendered.

EXCAVATING AND DEEPENING THE HARBOR AND CHANNEL, AND THE ENTRANCE AT THE FOOT OF CANANDAIGUA LAKE.

William H. Welch, contractor.

Act, chapter 218, Laws of 1900.

Appropriation, $10,000.

This contract provides for excavating a proper channel and harbor at the foot of Canandaigua lake.

There has been no work done under this contract.

BRIDGE OVER BLACK RIVER AT PRATTS LANDING, BETWEEN TOWNS OF TURIN AND GREIG, LEWIS COUNTY.

American Bridge Company, contractors.

Act, chapter 670, Laws of 1900.

Act, chapter 645, Laws of 1901.

Appropriation, $19,000.

This bridge will have one fixed span of 112 feet in the clear and one swing 126 feet long, constructed upon the modern lines of steel and iron, and will be of immense service to the people of Lewis county.

This work is in progress of erection and should be completed in three months.

CONSTRUCTING AND EXTENDING TOW PATH AT GENEVA, N. Y.

A. F. Chapman & Co., contractors.

Act, chapter 662, Laws of 1900.

Appropriation, $45,000.

The work included in this contract consists of constructing a pile and timber dock about 1,600 lineal feet in length across the foot of Seneca lake, in the city of Geneva.

The work is nearly completed and a final account will be rendered very soon.

CONTRACTS COMPLETED AND SETTLED (see Table No. 3.)

BRIDGES ACROSS SENECA AND CANANDAIGUA RIVERS, NEAR MONTEZUMA, N. Y.

Henry Tosh, contractor.

Act, chapter 224, Laws of 1900.

Appropriation, $8,000.

Final account, $7,206.05.

These bridges are constructed of wood and cannot be classed as durable structures, but if a close computation is entered into it would be found that the bridges may be renewed every ten years upon the present plan at much less cost than the interest of cost of a substantial steel structure at 4 per cent.

LIFT BRIDGE AT PETERBORO STREET, CANASTOTA, N. Y.

Havana Bridge Works, contractors.

Act, chapter 626, Laws of 1898.

Act, chapter 417, Laws of 1900.

Appropriation, $18,000.

Final account, $15,933.08.

This bridge crosses the Erie canal at the principal street in Canastota, is a steel structure upon a well matured plan, and answers the requirements of the people who have long been dissatisfied with the old Whipple cast iron arch overhead bridge with its steep approaches.

BRIDGE AT SOUTH GEORGE STREET, ROME, N. Y.

Owego Bridge Company, contractors.

Act, chapter 625, Laws of 1898.

Act, chapter 572, Laws of 1899.

Act, chapter 417, Laws of 1900.

Act, chapter 454, Laws of 1900.

Appropriation, $18,000.

Final account, $11,631.79.

This is a fixed bridge of steel construction over the Erie canal, having one roadway 20 feet wide and two sidewalks each 6 feet in width upon stone abutments.

FOREMAN STREET BRIDGE AT CAZENOVIA, N. Y.

John Kelley & Co., contractors.

Act, chapter 437, Laws of 1900.

Appropriation, $15,000.

Final account, $7,073.21.

This is a steel bridge with brick paved floor upon new stone abutments, over the outlet of Cazenovia lake at Foreman street. This structure is very complete and takes the place of a very narrow and inadequate crossing for a street and village of so much importance.

REPAIRING ABUTMENT, ETC., TO LIBERTY STREET BRIDGE AT PENN YAN, N. Y.

John R. Briggs, contractor.

Act, chapter 455, Laws of 1900.

Appropriation, $4,500.

Final account, $3,315.21.

The old abutment was found to be insecure and could not be safely repaired by reinforcing with concrete as at first proposed, but was entirely removed and a concrete abutment was constructed upon pile foundation, which makes the structure safe for use, but the retaining walls upon either side of the approach are in bad condition and must be rebuilt, for which chapter 681, Laws of 1901, provides an appropriation, and plans and estimate of cost have been made and the work is advertised to be put under contract.

REPAIRING TOW PATH BRIDGE AT THREE RIVER POINT, N. Y.

John Kelley & Co., contractors.

Act, chapter 445, Laws of 1900.

Appropriation, $10,000.

Final account, $2,193.49.

The repair of this bridge was done by contract, leaving other work, provided for in the appropriation of $10,000, to be done by the Superintendent of Public Works.

The work under this contract consisted chiefly in reinforcing the piers which had settled and decayed so as to render the structure unsafe for passage of towing teams.

In addition to work on the piers, the timber in superstructure that was found decayed was removed and new substituted, and the entire bridge thoroughly repainted. This structure will be sufficient for canal purposes for several years.

REPAIRING WELLS BROOK AQUEDUCT, BLACK RIVER CANAL.

Wilkes D. Dodge, contractor.

Act, chapter 311, Laws of 1900.

Final account, $2,935.31.

Work under this contract consisted principally of removing one pier which had become unsafe from settling of the foundation, and constructing a new cut-stone pier of Sugar River stone upon a pile foundation, and excavating in rear of one abutment and refilling with concrete to prevent leaking from the prism into the brook.

REBUILDING PITCHERS WASTE-WEIR, BLACK RIVER CANAL.

Wilkes D. Dodge, contractor.

Act, chapter 311, Laws of 1900.

Final account, $1,510.84.

This contract provides for rebuilding Pitcher's waste-weir on the Black River canal feeder near Boonville, the old structure having completely collapsed.

The new structure is of cut stone from Sugar River, and is substantial in all respects.

IMPROVEMENT OF PUBLIC HIGHWAYS.

Chapter 115, Laws of 1898.

Chapter 569, Laws of 1900.

Contracts in force at the close of the fiscal year.

(See Table No. 4.)

CUYLER ROAD.

Petition No. 93. Road No. 40.

This is a portion of old Homer and Sherburne turnpike, and extends through the unincorporated village of Truxton, Cortland county, 0.45 miles in length.

The work of constructing this road was placed under contract July 16, 1901, to the town board of Truxton, and at the close of the fiscal year is so far advanced that its completion this fall is assured.

CHENANGO RIVER ROAD.

Petition No. 134. Road No. 47.

This highway extends from the city limits of Binghamton, N. Y., to a point where the division line between the towns of Chenango and Dickinson intersects the highway, on the west side of the Chenango River, a distance of about 1.75 miles.

The contract for construction of this road was let August 12, 1901, to Chambers & Casey, and the work is being earnestly prosecuted, and without doubt will be completed before the close of the season this fall.

CONTRACTS COMPLETED AND SETTLED DURING THE FISCAL YEAR.

(See Table No. 5.)

SAUQUOIT CREEK ROAD.

Petition No. 91. Road No. 21.

This road extends from the westerly line of the city of Utica west to Sauquoit Creek, in the town of Whitestown, Oneida county.

The work is completed and contract settled.

CORTLAND STREET ROAD.

Petition No. 11. Road No. 8.

This road extends from Candee's Hotel at Onondaga Valley to Dorwin's Spring Brook, a distance of 1.20 miles.

The work under this contract was nearly completed last fall before work was suspended on account of cold weather, and as soon as suitable weather came last spring the work remaining to be done was completed and contract settled.

The completed roads have been examined from time to time, and thus far all have sustained the travel without much change, yet some work should be done next spring on maintenance account in order to prevent rutting, and in cleaning ditches and grading the shoulders.

SURVEYS.

In addition to surveys made prior to September 30, 1900, and reported in my last annual report, the following roads have been surveyed during the present fiscal year.

ONEIDA COUNTY, N. Y.

Petition No. 173. Hamilton Bridge road extends "from Hamilton bridge over Oneida Creek at Oneida and Madison counties; thence northerly to Kingsley Four Corners; thence northerly and westerly to Mud Creek bridge; thence northerly and westerly in the town of Verona." Distance, 1.29 miles.

Petition No. 174. Seneca turnpike extends "from five-eighths of a mile east of Vernon village to four corners at M. E. Church in Vernon." Distance, about 2.00 miles.

ONONDAGA COUNTY, N. Y.

Petition No. 184. Fabius and Apulia road, second section. "Beginning at the east end of section No. 1, at station No. 162, of the State Engineer's survey, thence easterly upon the line of said survey about 4,700 feet to the intersection of the proposed new line of road with the road leading from Apulia station to Fabius village." Distance, 0.84 miles.

BROOME COUNTY, N. Y.

Petitions Nos. [illegible] and [illegible]. Chenango River road, "extends from the city limits of Binghamton northerly to a point about

325 feet northerly from the intersection of the towns of Chenango and Dickinson."

The construction of this road is in progress and is about one-fourth completed. Distance, 1.75 miles.

Petition No. 160. Fenton road, "extends from dividing line between the towns of Dickinson and Fenton northerly to Chenango canal tow-path in the town of Fenton." Distance, 2.17 miles.

Petition No. 200. Park Bridge road, "extends from Binghamton easterly on north side of the Susquehanna River to Park Bridge." Distance, 2.04 miles.

Petition No. 149. Extension of Town Line road, "extends from a point 325 feet northerly of the dividing line between the towns of Chenango and Dickinson to a point about two miles northerly." Distance, 1.97 miles.

Petition No. 148. Lestershire road, "extends from west line of the village of Lestershire to a point where road leading to the Erie railroad station intersects." Distance, 2.96 miles.

CORTLAND COUNTY, N. Y.

Petition No. 161. Blodgett's Mills road, "extends from east line of the city of Cortland to the lands of the S. B. & N. Y. R. R. Company." Distance, 0.75 miles.

TOMPKINS COUNTY, N. Y.

Petition No. 141. Catskill turnpike, "extends from the eastern limits of the city of Ithaca to easterly bounds of Ithaca Township." Distance, 1.87 miles.

ST. LAWRENCE COUNTY, N. Y.

Petition No. 151. Childwold Park and Tupper Lake road, "extends from the Adirondack and St. Lawrence railroad station at Childwold Park station to junction of road from Tupper Lake to Childwold, and the Tupper Lake road along Lake Massawepie." Distance, 5.89 miles.

Maps, plans, estimates and specifications for all of the foregoing roads are in a good state of forwardness, and all will be completed in time to present to the proper boards of supervisors at the annual sessions in November, 1901.

RECAPITULATION OF WORK DONE ON ROADS TO SEPTEMBER 30, 1901.

The following table has been prepared which shows counties in the Middle Division.

Miles under contract during the year ending September 30, 1900.

Miles of plans and estimates completed prior to September 30, 1901.

Miles of plans and estimates completed during the year ending September 30, 1901.

Miles of surveys made during the year ending September 30, 1901.

Miles of contracts completed prior to September 30, 1900.

Miles of contracts completed prior to September 30, 1901.

Miles of contracts completed during the year ending September 30, 1901.

Recapitulation of Work Done to September 30, 1901.

COUNTY.	Miles under contract during year ending September 30, 1901.	Miles of plans and estimates completed prior to September 30, 1900.	Miles of plans and estimates completed prior to September 30, 1901.	Miles of plans and estimates completed during year ending September 30, 1901.	Miles of surveys made during year ending September 30, 1901.	Miles of contracts completed prior to September 30, 1900.	Miles of contracts completed prior to September 30, 1901.	Miles of contracts completed during year ending September 30, 1901.
Broome	1.75	....	4.71	4.71	10·89	....	....	....
Cayuga	....	....	2.19	2.19	....	....	....	....
Chenango	....	....	4.84	4.84	....	....	....	....
Cortland	0.47	....	0.47	0.47	0.75	....	....	....
Jefferson	....	....	....	....	....	....	....	....
Lewis	....	....	....	....	....	....	....	....
Madison	....	....	....	....	....	....	....	....
Oneida	....	3.58	8.78	5.20	3.57	2.25	3.58	1.33
Onondaga	....	3.67	13.04	9.37	....	0.58	1.78	1.20
Oswego	....	2.48	2.48	....	....	....	....	....
St. Lawrence	....	....	....	....	5.89	....	....	....
Seneca	....	....	....	....	....	....	....	....
Tioga	....	....	....	....	....	....	....	....
Tompkins	....	....	1.87	1.87	1.87	....	....	....
Total	2.22	9.73	38.38	28.65	22.97	2.83	5.36	2.53

IN CONCLUSION.

While the working force in this department the past year has been limited to actual necessities, varying considerably from time to time, the work in the field and office has been kept under close supervision and only such persons employed as would render competent and efficient service, and it gives your Division Engineer great pleasure to thank the State Engineer and Surveyor, and his Deputy Wm. Pierson Judson for uniform courtesy and assistance in the discharge of his duty, and to Resident Engineer Henry C. Allen, and First Assistant Engineer Guy Moulton, as well as every subordinate member of the force for their faithful attention to the business of the department, as well as their uniform courtesy and good feeling towards each other in their daily intercourse.

Very respectfully submitted,

W. H. H. GERE,

Division Engineer.

TABLE No. 1.

STATEMENT SHOWING THE NAMES, RANK AND COMPENSATION OF ENGINEERS EMPLOYED ON THE MIDDLE DIVISION OF THE NEW YORK STATE CANALS, TOGETHER WITH THE INCIDENTAL EXPENSES FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1901.

Ordinary Repairs, Erie Canal.

(Chapter 418, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
W. H. H. Gere	Division engineer	....	$3,000 per yr.	$1,350 00	$158 42	$1,508 42
Henry C. Allen	Resident engineer	....	2,400 per yr.	204 69	14 84	219 53
Frank B. Chapman	Confidential clerk	300	5 00 per day	1,500 00	....	1,500 00
Guy Moulton	First ass't engineer	67	6 00 per day	402 00	86 98	488 98
D. E. Whitford	Assistant engineer	3	5 00 per day	15 00	13 77	28 77
Noble E. Whitford	Assistant engineer	9	5 00 per day	45 00	25 99	70 99
Fred W. Sarr	Assistant engineer	7	5 00 per day	35 00	10 43	45 43
E. J. Berry	Leveler	10	4 50 per day	45 00	15 64	60 64
Fred J. Wagner	Leveler	2	4 50 per day	9 00	8 73	17 73
L. K. Devendorf	Rodman	9	3 50 per day	31 50	5 22	36 72
George H. Thomas	Rodman	9	3 50 per day	31 50	....	31 50
George H. Thomas	Chainman	1	3 00 per day	3 00	....	3 00
Howard U. Lyon	Chainman	74	3 00 per day	222 00	....	222 00
Howard Crounse	Chainman	214	3 00 per day	642 00	....	612 00
C. H. Mattison	Chainman	10	3 00 per day	30 00	1 35	31 35
Jeanne M. Crippen	Tracer	151	2 00 per day	302 00	....	302 00
						$5,209 09

Incidental Expenses

Labor	$28 00	
Livery	37 25	
Stationery and printing	153 11	
Fuel and light	197 34	
Postage	45 99	
Telephone and telegraph	229 43	
Miscellaneous	856 07	
		1,547 19
Total		$6,756 28

Ordinary Repairs, Oswego Canal.

(Chapter 418, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
W. H. H. Gere	Division engineer	....	$3,000 per yr.	$525 [illegible]	....	$525 [illegible]
Henry C. Allen	Resident engineer	....	2,400 per yr.	7 [illegible]	$2 55	9 55
Guy Moulton	First ass't engineer	4	6 00 per day	24 00	3 [illegible]	27 [illegible]
						$562 35

Incidental Expenses

Livery	$4 00	
Miscellaneous	77	
		4 77
Total		$567 12

Ordinary Repairs, Black River Canal.

(Chapter 418, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
W. H. H. Gere	Division engineer	....	$3,000 per yr.	$175 00	....	$175 00
Henry C. Allen	Resident engineer	....	2,400 per yr.	22 22	$8 85	31 07
Fred W. Sarr	Assistant engineer	4	5 00 per day	20 00	16 70	36 70
C. H. Mattison	Chainman	2	3 00 per day	6 00	....	6 00
						$248 77
Incidental Expenses.						
Labor					$2 50	
Miscellaneous					2 70	
						5 20
Total						$253 97

Ordinary Repairs, Cayuga and Seneca Canal.

(Chapter 418, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
W. H. H. Gere	Division engineer	....	$3,000 per yr.	$445 00	$3 88	$448 88

Extraordinary Repairs and Improvements, Richmond Aqueduct.

(Chapter 311, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Henry C. Allen	Resident engineer	....	$2,400 per yr.	$16 03	$3 15	$19 18
Fred J. Wagner	Leveler	1	4 50 per day	4 50	3 02	7 52
						$26 70
Incidental Expenses.						
Labor					$2 00	
Livery					2 00	
Stationery and printing					18 52	
Miscellaneous					35	
						22 87
Total						$49 57

Extraordinary Repairs and Improvements, Fence Around Geddes Basin.

(Chapter 347, Laws 1901.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Henry C. Allen	Resident engineer	....	$2,400 per yr.	$29 63	$0 20	$29 83
C. H. Mattison	Chainman	4	3 00 per day.	12 00	....	12 00
Total	....	....	....	....	....	$41 83

Extraordinary Repairs and Improvements, Repairing Wells Brook Aqueduct.

(Chapter 311, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Henry C. Allen	Resident engineer	....	$2,400 per yr.	$46 51	$9 12	$55 63
Guy Moulton	First ass't engineer.	9	6 00 per day	54 00	8 08	62 08
Fred W. Sarr	Assistant engineer.	53	5 00 per day	265 00	21 03	286 03
L. K. Devendorf	Rodman	3	3 50 per day	10 50	50	11 00
Howard Crounse	Chainman	2	3 00 per day	6 00	....	6 00
C. H. Mattison	Chainman	2	3 00 per day	6 00	....	6 00
						$426 74

Incidental Expenses.

Labor	$11 00	
Livery	53 50	
Stationary and printing	68 68	
Postage	30	
Telephone and telegraph	75	
Miscellaneous	8 99	
		143 22
Total		$569 96

Extraordinary Repairs and Improvements, Rebuilding Pitcher's Waste-weir.

(Chapter 311, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Henry C. Allen	Resident engineer	....	$2,400 per yr.	$23 10	$10 71	$33 81
Guy Moulton	First ass't engineer	8	6 00 per day	48 00	13 97	61 97
Fred W. Sarr	Assistant engineer	22	5 00 per day	110 00	8 26	118 26
L. K. Devendorf	Rodman	28	3 50 per day	98 00	8 11	106 11
Howard Crounse	Chainman	2	3 00 per day	6 00	....	6 00
						$326 15
Incidental Expenses.						
Labor					$6 35	
Livery					6 00	
Stationery and printing					42 75	
Telephone and telegraph					2 01	
Miscellaneous					10 86	
						67 97
Total						$394 12

Extraordinary Repairs and Improvements, Improving Locks, Black River Canal.

(Chapter 311, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
W. H. H. Gere	Division engineer	....	$3,000 per yr.	$50 00	....	$50 00
Henry C. Allen	Resident engineer	....	2,400 per yr.	30 77	....	30 77
L. K. Devendorf	Rodman	4	3 50 per day	14 00	....	14 00
Howard U. Lyon	Chainman	16	3 00 per day	48 00	$1 84	49 84
Howard Crounse	Chainman	25	3 00 per day	75 00	....	75 00
C. H. Mattison	Chainman	13	3 00 per day	39 00	....	39 00
						$258 61
Incidental Expenses.						
Miscellaneous						9 50
Total						$268 11

Extraordinary Repairs and Improvements, Repairs to Adirondack Reservoirs and Roads. Inserting Pipes at South Lake.

(Chapter 347, Laws 1901.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Henry C. Allen	Resident engineer	....	$2,400 per yr.	$22 81	$8 10	$30 91
Fred W. Sarr	Assistant engineer	19	5 00 per day	95 00	26 10	121 10
Fred J. Wagner	Leveler	33	4 50 per day	148 50	43 52	192 02
L. K. Devendorf	Rodman	1	3 50 per day	3 50	....	3 50
C. H. Mattison	Chainman	8	3 00 per day	24 00	....	24 00
						$371 53
Incidental Expenses.						
Livery					$24 00	
Telephone and telegraph					85	
Miscellaneous					2 70	
						27 55
Total						$399 08

Improving Harbor, Canandaigua Lake.

(Chapter 218, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Henry C. Allen	Resident engineer	...	$2,400 per yr.	$15 39	....	$15 39
E. C. [illegible]	Draftsman	1½	4 50 per day	6 75	....	6 75
Total						$22 14

Bridges at Montezuma.

(Chapter 224, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Henry C. Allen	Resident engineer	....	$2,400 per yr.	$30 20	$4 54	$34 74
Guy Moulton	First ass't engineer.	1	6 00 per day	6 00	....	6 00
Fred W. Sarr	Assistant engineer	3	5 00 per day	15 00	7 57	22 57
Noble E. Whitford	Assistant engineer	3	5 00 per day	15 00	....	15 00
E. J. Berry	Leveler	8	4 50 per day	36 00	8 55	44 55
E. J. Berry*	Leveler	48	2 25 per day	108 00	4 64	112 64
Howard U. Lyon	Chainman	4	3 00 per day	12 00	....	12 00
Howard Crounse	Chainman	2	3 00 per day	6 00	....	6 00
George H. Thomas	Chainman	2	3 00 per day	6 00	1 96	7 96
C. H. Mattison	Chainman	4	3 00 per day	12 00	....	12 00
						$273 46

Incidental Expenses.

Labor	$6 00	
Livery	1 50	
Postage	61	
Miscellaneous	22 15	
		30 26
Total		$303 72

* Superintendent of Public Works pays $2.25 per day for inspection.

For Continuing Construction of New Road on Indian Reservation.

(Chapter 645, Laws of 1901.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Guy Moulton	First ass't engineer.	1	$6 00 per day	$6 00	$2 30	$8 30
George H. Thomas	Rodman	1	3 50 per day	3 50	....	3 50
Howard U. Lyon	Chainman	1	3 00 per day	3 00	....	3 00
						$14 80

Incidental Expenses.

Labor	$2 00	
Livery	5 00	
		7 00
Total	.....	$21 80

Brasher Falls Dam, St. Regis River.

(Chapter 645, Laws 1901.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Henry C. Allen	Resident engineer	....	$2,400 per yr.	$51 86	$11 52	$63 38
Fred W. Sarr	Assistant engineer	6	5 00 per day	30 00	17 97	47 97
L. K. Devendorf	Rodman	6	3 50 per day	21 00	....	21 00
						$132 35
Incidental Expenses.						
Labor					$11 00	
Livery					2 50	
Stationery and printing					1 00	
Miscellaneous					3 45	
						17 95
Total						$150 30

Washington Street Bridge, Utica.

(Chapter 397, Laws 1898; Chapter 402, Laws 1900; Chapter 537, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Henry C. Allen	Resident engineer	....	$2,400 per yr.	$67 51	$18 64	$86 15
Guy Moulton	First ass't engineer	1	6 00 per day	6 00	1 58	7 58
Arthur O'Brien	Assistant engineer	53	5 00 per day	265 00	14 10	279 10
Fred J. Wagner	Leveler	25	4 50 per day	112 50	18 00	130 50
George H. Thomas	Chainman	81	3 00 per day	243 00	2 16	245 16
						$748 49
Incidental Expenses.						
Labor					$1 50	
Stationery and printing					90	
Postage					1 00	
Telephone and telegraph					5 52	
Miscellaneous					7 82	
						16 74
Total						$765 23

Schuyler Street Bridge, Utica.

(Chapter 427, Laws 1898; Chapter 417, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Henry C. Allen	Resident engineer	...	$2,400 per yr.	$31 77	$2 00	$33 77
Guy Moulton	First ass't engineer	5	6 00 per day.	30 00	....	30 00
Arthur O'Brien	Assistant engineer	27	5 00 per day.	135 00	11 00	146 00
Fred J. Wagner	Leveler	66	4 50 per day.	297 00	36 82	333 82
						$543 59

Incidental Expenses.

Labor	$4 00	
Stationery and printing	1 80	
Postage	90	
Telephone and telegraph	2 53	
Miscellaneous	4 60	
		13 83
Total		$557 42

George Street Bridge, Rome.

(Chapter 625, Laws 1898; Chapter 573, Laws 1899; Chapter 417, Laws 1900; Chapter 454, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
W. H. H. Gere	Division engineer	....	$3,000 per yr.	$62 50	$4 12	$66 62
Henry C. Allen	Resident engineer	....	2,400 per yr.	100 45	24 12	124 57
Guy Moulton	First ass't engineer	3	6 00 per day	18 00	1 56	19 56
Arthur O'Brien	Assistant engineer	58	5 00 per day	290 00	70 92	360 92
Fred J. Wagner	Leveler	9	4 50 per day	40 50	37 51	78 01
*Fred J. Wagner	Leveler	24	2 50 per day	60 00	....	60 00
L. K. Devendorf	Rodman	4	3 50 per day	14 00	....	14 00
George H. Thomas	Chainman	44	3 00 per day	132 00	1 08	133 08
Howard Crounse	Chainman	4	3 00 per day	12 00	....	12 00
C. H. Mattison	Chainman	9	3 00 per day	27 00	....	27 00
						$895 76

Incidental Expenses.

Stationery and printing	$61 55	
Postage	1 95	
Telephone and telegraph	4 66	
Miscellaneous	36 08	
		104 24
Total		$1,000 00

*Superintendent of Public Works pays $2 per day for inspection.

Peterboro Street Bridge, Canastota.

(Chapter 626, Laws 1898, and Chapter 417, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
W. H. H. Gere	Division engineer	....	$3,600 per yr.	$25 00	....	$25 00
Fred J. Wagner	Leveler	8	4 50 per day	36 00	$14 90	50 90
						$75 90

Incidental Expenses.

Postage	3 43
Total	$79 33

Catherine Street Bridge, Syracuse.

(Chapter 424, Laws 1898, and Chapter 547, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Henry C. Allen	Resident engineer	....	$2,400 per yr.	$15 38	....	$15 38
Guy Moulton	First ass't engineer	1	6 00 per day	6 00	....	6 00
E. J. Berry	Leveler	112	4 50 per day	504 00	$0 20	504 20
* E. J. Berry	Leveler	79	2 50 per day	197 50	05	197 55
Howard U. Lyon	Chainman	1	3 00 per day	3 00	....	3 00
						$726 13

Incidental Expenses.

Labor	$2 00	
Postage	80	
Miscellaneous	116 56	
		119 36
Total		$845 49

* Superintendent of Public Works pays $2 per day for inspection.

Foreman Street Bridge, Cazenovia.

(Chapter 437, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
W. H. H. Gere	Division engineer	....	$3,000 per yr.	$50 00	$2 50	$52 50
Henry C. Allen	Resident engineer	....	2,400 per yr.	108 04	5 00	113 04
Guy Moulton	First ass't engineer	10	6 00 per day	60 00	5 28	65 2
Fred. J. Wagner	Leveler	120	4 50 per day	540 00	25 79	565 79
L. K. Devendorf	Rodman	1	3 50 per day	3 50	....	3 50
Howard Crounse	Chainman	6	3 00 per day	18 00	....	18 00
						$818 11
Incidental Expenses.						
Labor					$10 00	
Stationery and printing					60 55	
Postage					88	
Telephone and telegraph					2 01	
Miscellaneous					19 45	
						92 89
Total						$911 00

Completing Bridge at Inlet, Otisco Lake.

(Chapter 387, Laws 1900, and Chapter 417, Laws 1900.)

NAME.	Rank.	Number of days	Rate of compensation.	Salary.	Travel.	Total.
W. H. H. Gere	Division engineer	....	$3,000 per yr.	$50 00	....	$50 00
Henry C. Allen	Resident engineer	....	2,400 per yr.	29 63	$1 00	30 63
Frank B. Chapman	Confidential clerk	5	5 00 per day	25 00	....	25 00
Howard Crounse	Chainmen	8	3 00 per day	24 00	....	24 00
						$129 63
Incidental Expenses.						
Livery					$5 00	
Postage					1 61	
						6 61
Total						$136 24

Improving Limestone Creek.

(Chapter 419, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
W. H. H. Gere	Division engineer	....	$3,000 per yr.	$25 00	....	$25 00
Henry C. Allen	Resident engineer	....	2,400 per yr.	64 11	$0.30	64 41
Guy Moulton	First ass't engineer	4	6 00 per day	24 00	1.90	25 90
Howard Crounse	Chainman	2	3 00 per day	6 00	....	6 00
						$121 31
Incidental Expenses.						
Labor					$6 00	
Postage					58	
						6 58
Total						$127 89

Repairing Wall at Skaneateles.

(Chapter 419, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Guy Moulton	First ass't engineer	3	$6 00 per day	$18 00	$5.46	$23 46
L. K. Devendorf	Rodman	2	3 50 per day	7 00	....	7 00
Howard U. Lyon	Chainman	1	3 00 per day	3 00	....	3 00
						$33 46
Incidental Expenses.						
Labor						2 00
Total						$35 46

Repairing Sea Walls, Owasco Lake.

(Chapter 419, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Henry C. Allen	Resident engineer	....	$2,400 per yr.	$15 38	$1 00	$16 38

Filling in North Side Cut at Spring Street, Syracuse.

(Chapter 645, Laws 1901.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Henry C. Allen	Resident engineer	....	$2,400 per yr.	$14 82	....	$14 82
Guy Moulton	First ass't engineer	4	6 00 per day	24 00	$0 20	24 20
Fred W. Sarr	Assistant engineer	2	5 00 per day	10 00	....	10 00
L. K. Devendorf	Rodman	1	3 50 per day	3 50	....	3 50
Howard Crounse	Chainman	1	3 00 per day	3 00	....	3 00
						$55 52
Incidental Expenses.						
Stationery and printing						3 63
Total						$62 15

Raising Oswego Dam, Oswego River.

(Chapter 645, Laws 1901.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Henry C. Allen	Resident engineer	....	$2,400 per yr.	$23 81	$3 80	$26 61
Fred W. Sarr	Assistant engineer	2	5 00 per day	10 00	....	10 00
L. K. Devendorf	Rodman	1	3 50 per day	3 50	....	3 50
Howard U. Lyon	Chainman	1	3 00 per day	3 00	....	3 00
Howard Crounse	Chainman	2	3 00 per day	6 00	....	6 00
						$49 11
Incidental Expenses.						
Livery					$2 00	
Stationery and printing					9 54	
						11 54
Total						$60 65

Raising High Dam, Oswego River.

(Chapter 645, Laws 1901.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Henry C. Allen	Resident engineer	....	$2,400 per yr.	$7 41	....	$7 41
L. K. Devendorf	Rodman	2	3 50 per day	7 00	....	7 00
Howard Crounse	Chainman	2	3 00 per day	6 00	....	6 00
						$20 41
Incidental Expenses.						
Stationery and printing						10 12
Total						$30 53

Raising Minetto Dam, Oswego River.

(Chapter 645, Laws 1901.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Henry C. Allen	Resident engineer	....	$2,400 per yr.	$7 41	....	$7 41
L. K. Devendorf	Rodman	2	3 50 per day	7 00	....	7 00
Howard Crounse	Chainman	2	3 00 per day	6 00	....	6 00
						$20 41
Incidental Expenses.						
Stationery and printing						12 09
Total						$32 50

For Repairing Bridge over Oneida River at Three River Point.

(Chapter 445, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Henry C. Allen	Resident engineer	....	$2,400 per yr.	$38 46	$1 80	$40 26
Guy Moulton	First ass't engineer	16	6 00 per day	96 00	4 68	100 68
L. K. Devendorf	Rodman	3	3 50 per day	10 50	....	10 50
Howard Crounse	Chainman	1	3 00 per day	3 00	....	3 00
						$154 44
Incidental Expenses.						
Labor					$2 00	
Stationery and printing					26 64	
Postage					07	
						28 71
Total						$183 15

Guard Lock, Etc., Cayuga and Seneca Canal and Seneca River, for Regulating the Waters of Seneca Lake.

(Chapter 680, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
W. H. H. Gere	Division engineer	....	$3,000 per yr.	$125 00	$14 18	$139 18
Henry C. Allen	Resident engineer	....	2,400 per yr.	215 37	31 42	246 79
Guy Moulton	First ass't engineer	4	6 00 per day	24 00	6 36	30 36
D. E. Whitford	Assistant engineer	143	5 00 per day	715 00	87 29	802 29
Geo. A. Fairbanks	Assistant engineer	26	5 00 per day	130 00	....	130 00
Noble E. Whitford	Assistant engineer	32	5 00 per day	160 00	....	160 00
John G. Peck	Bridge designer	....	2,000 per yr.	166 67	....	166 67
E. C. Clark	Leveler	162	4 50 per day	729 00	44 04	773 04
Fred. J. Wagner	Leveler	1	4 50 per day	4 50	2 18	6 68
L. K. Devendorf	Rodman	6	3 50 per day	21 00	....	21 00
C. H. Mattison	Chainman	1	3 00 per day	3 00	....	3 00

Incidental Expenses.		$2,479 01
Labor	$513 50	
Livery	18 00	
Stationery and printing	6 69	
Office rent	17 50	
Postage	2 30	
Telephone and telegraph	3 30	
Miscellaneous	37 75	
		599 04
Total		$3,078 05

Extending Tow-path, Cayuga and Seneca Canal, Geneva.

(Chapter 662, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
W. H. H. Gere	Division engineer	....	$3,000 per yr.	$107 50	$11 11	$118 61
Henry C. Allen	Resident engineer	....	2,400 per yr.	244 72	9 36	254 08
Guy Moulton	First ass't engineer	2	6 00 per day	12 00	5 16	17 16
D. E. Whitford	Assistant engineer	133	5 00 per day	665 00	24 61	689 61
E. C. Clark	Leveler	28	4 50 per day	126 00	40	126 40

Incidental Expenses.		$1,205 86
Labor	$303 50	
Livery	9 50	
Stationery and printing	2 80	
Office rent	35 00	
Postage	3 30	
Telephone and telegraph	1 15	
Miscellaneous	26 59	
		$381 84
Total		$1,587 70

Bridge at Seneca Falls, Cayuga and Seneca Canal.

(Chapter 224, Laws 1899, and Chapter 396, Laws 1900.

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Henry C. Allen	Resident engineer	....	$2,400 per yr.	$39 08	$2 88	$41 96
Guy Moulton	First ass't engineer	1	6 00 per day	6 00	2 18	8 18
D. E. Whitford	Assistant engineer	27	5 00 per day	135 00	59 35	194 35
E. C. Clark	Leveler	31	4 50 per day	139 50	34 90	174 40
Fred J. Wagner	Leveler	6	4 50 per day	27 00	7 38	34 38
						$453 27
Incidental Expenses.						
Labor					$56 00	
Stationery and printing					10	
Postage					04	
Telephone and telegraph					2 18	
Miscellaneous					5 87	
						64 19
Total						$517 46

Dredging Inlet and Repairing Pier, Cayuga Lake.

(Chapter 645, Laws 1901.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Henry C. Allen	Resident engineer	....	$2,400 per yr.	$23 41	$7 22	$30 63
Guy Moulton	First ass't. engineer	8	6 00 per day	48 00	41 62	89 62
L. K. Devendorf	Rodman	4	3 50 per day	14 00	....	14 00
Howard U. Lyon	Chainman	4	3 00 per day	12 00	....	12 00
C. H. Mattison	Chainman	4	3 00 per day	12 00	....	12 00
						$158 25
Incidental Expenses.						
Livery					$1 00	
Stationery and printing					6 55	
Miscellaneous					4 20	
						11 75
Total						$170 00

Abutments, Bridge at Penn Yan.

(Chapter 455, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Henry C. Allen	Resident engineer	....	$2,400 per yr.	$70 58	$30 83	$101 41
Guy Moulton	First ass't engineer	7	6 00 per day	42 00	19 78	61 78
E. C. Clark	Leveler	11	4 50 per day	49 50	7 08	56 58
*E. C. Clark	Leveler	69	2 50 per day	172 50	14 46	186 96
L. K. Devendorf	Rodman	1	3 50 per day	3 50	....	3 50
Carl F. Hopstein	Laborer	....	....	....	8 18	8 18
						$418 41
Incidental Expenses.						
Labor					$10 00	
Stationery and printing					37 86	
Postage					2 15	
Telephone and telegraph					2 74	
Miscellaneous					4 54	
						57 29
Total						$475 70

* Superintendent of Public Works pays $3 per day for inspection.

Repairing Approach, Liberty Street Bridge, Penn Yan.

(Chapter 681, Laws 1901.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Guy Moulton	First ass't engineer	3	$6 00 per day	$18 00	....	$18 00
Incidental Expenses.						
Stationery and printing						6 83
Total						$24 83

Bridge at Pratt's Landing, Black River.

(Chapter 670, Laws 1900, and Chapter 645, Laws 1901.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Henry C. Allen	Resident engineer	....	$2,400 per yr.	$29 63	....	$29 63
D. E. Whitford	Assistant engineer	2	5 00 per day	10 00	....	10 00
E. J. Berry	Leveler	6	4 50 per day	27 00	$7 36	34 36
						$73 99
Incidental Expenses.						
Labor					$12 00	
Livery					2 00	
Stationery and printing					65 86	
Miscellaneous					55	
						80 41
Total						$154 40

Surveys for State Court of Claims.

(Chapter 419, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Henry C. Allen	Resident engineer	....	$2,400 per yr.	$37 32	$13 40	$50 72
Frank B. Chapman	Confidential clerk	6	5 00 per day	30 00	....	30 00
Guy Moulton	First ass't engineer	105	6 00 per day	630 00	370 48	1,000 48
D. E. Whitford	Assistant engineer	5	5 00 per day	25 00	4 16	29 16
E. J. Berry	Leveler	29	4 50 per day	130 50	11 05	141 55
Fred J. Wagner	Leveler	17	4 50 per day	76 50	30	76 80
E. C. Olcott	Draftsman	26	4 50 per day	117 00	....	117 00
L. K. Devendorf	Rodman	37½	3 50 per day	131 25	....	131 25
Geo. H. Thomas	Rodman	23	3 50 per day	80 50	....	80 50
Geo. H. Thomas	Chainman	41	3 00 per day	123 00	....	123 00
Howard U. Lyon	Chainman	65	3 00 per day	195 00	....	195 00
Howard Crounse	Chainman	12	3 00 per day	36 00	....	36 00
C. H. Mattison	Chainman	35	3 00 per day	105 00	....	105 00
						$2,116 46
Incidental Expenses.						
Labor					$190 00	
Livery					171 25	
Stationery and printing					21 15	
Telephone and telegraph					70	
Miscellaneous					19 05	
						402 15
Total						$2,518 61

Barge Canal Survey, Erie Canal.

(Chapter 411, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
W. H. H. Gere	Division engineer	....	$3,000 per yr.	$250 00	$8 37	$258 37
Frank B. Chapman	Confidential clerk	27	5 00 per day	135 00	....	135 00
Howard U. Lyon	Chainman	44	3 00 per day	132 00	....	132 00
Howard Crounse	Chainman	27	3 00 per day	81 00	....	81 00
Frank G. Bartlett	Chainman	31	2 50 per day	77 50	....	77 50
Jeanne M. Crippen	Tracor	11	2 00 per day	22 00	....	22 00
W. G. Stearns	Supt. of borings	28	6 00 per day	168 00	98 25	266 25
B. T. Feely	Supt. of borings	21	6 00 per day	126 00	103 82	229 82
Chas. Foster	Foreman of borings	30	3 25 per day	97 50	15 50	113 00
Luman Green	Foreman of borings	30	3 25 per day	97 50	15 50	113 00
John F. Tunney	Foreman of borings	19	3 25 per day	61 75	11 00	72 75
Patrick Navin	Foreman of borings	19	3 25 per day	61 75	11 00	72 75
Samuel Wood	Foreman of borings	19	3 25 per day	61 75	11 00	72 75
M. V. McCoy	Foreman of borings	24	3 25 per day	78 00	13 50	91 50
George Kirk	Foreman of borings	19	3 25 per day	61 75	11 00	72 75
M. Tierney	Foreman of borings	19	3 25 per day	61 75	10 50	72 25
P. A. Grogan	Foreman of borings	19	3 25 per day	61 75	11 00	72 75
John P. Seibel	Laborer	....	....	....	18 00	18 00
Edward Meaney	Laborer	....	....	....	15 50	15 50
L. B. Sheldon	Laborer	....	....	....	13 50	13 50
B. E. Sheldon	Laborer	....	....	....	13 50	13 50
Michael Murray	Laborer	....	....	....	11 00	11 00
William Hayes	Laborer	....	....	....	11 00	11 00
Thomas Bowes	Laborer	....	....	....	11 00	11 00
H. W. Stoneburgh	Laborer	....	....	....	13 50	13 50
Charles Shaw	Laborer	....	....	....	13 50	13 50
H. M. Munroe	Laborer	....	....	....	12 50	12 50
Eugene Reardon	Laborer	....	....	....	11 00	11 00
John Marra	Laborer	....	....	....	11 00	11 00
Thomas Shea	Laborer	....	....	....	11 00	11 00
James Driscoll	Laborer	....	....	....	11 00	11 00
J. E. Brastow	Laborer	....	....	....	13 50	13 50
James Hickey	Laborer	....	....	....	11 00	11 00
John Barter	Laborer	....	....	....	11 00	11 00
James Cahill	Laborer	....	....	....	11 00	11 00
Patrick Marr	Laborer	....	....	....	14 50	14 50
Howard Baker	Laborer	....	....	....	13 50	13 50
T. F. Crowley	Laborer	....	....	....	11 00	11 00
William Galvin	Laborer	....	....	....	11 00	11 00
Edward Hollihan	Laborer	....	....	....	11 00	11 00
Thomas F. Maloney	Laborer	....	....	....	11 00	11 00
Alexander Peckham	Laborer	....	....	....	10 50	10 50
Henry Gaylor	Laborer	....	....	....	7 50	7 50
Gordon Meighan	Laborer	....	....	....	10 50	10 50
Charles Brookman	Laborer	....	....	....	5 50	5 50
John J. Desmond	Laborer	....	....	....	13 00	13 00
						$2,297 94

Incidental Expenses.

Labor	$1,210 00	
Livery	60 50	
Stationery and printing	80	
Office rent	7 00	
Postage	11 23	
Telephone and telegraph	3 05	
Miscellaneous	784 40	
		2,076 98
Total		$4,374 92

Highway Improvements.

(Chapter 115, Laws 1898; Chapter 569, Laws 1899; Chapter 419, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
W. H. H. Gere	Division engineer	....	$3,000 per yr.	$10 00	....	$10 00
Henry C. Allen	Resident engineer	....	2,400 per yr.	581 01	$155 66	736 67
Guy Moulton	First ass't engineer	49	6 00 per day	294 00	43 52	337 52
Fred W. Sarr	Assistant engineer	200	5 00 per day	1,000 00	307 23	1,307 23
Arthur O'Brien	Assistant engineer	1	5 00 per day	5 00	1 05	6 05
Fred J. Wagner	Leveler	1	4 50 per day	4 50	1 52	6 02
E. C. Clark	Leveler	1	4 50 per day	4 50	5 96	10 46
L. B. Jones	Leveler	14¼	4 50 per day	64 12	29 42	93 54
H. P. Willis	Leveler	14¼	4 50 per day	64 12	29 42	93 54
E. C. Olcott	Draftsman	65½	4 50 per day	294 75	2 96	297 71
L. K. Devendorf	Rodman	191¾	3 50 per day	671 13	16 68	687 81
Geo. H. Thomas	Rodman	19	3 50 per day	66 50	....	66 50
Nathan E. Young	Rodman	12	3 50 per day	42 00	6 50	48 50
Howard V. Lyon	Chainman	107	3 00 per day	321 00	....	321 00
C. H. Mattison	Chainman	163½	3 00 per day	490 50	1 18	491 68
Geo. H. Thomas	Chainman	97⅞	3 00 per day	293 62	5 57	299 19
						$4,812 42
Incidental Expenses.						
Labor					$352 45	
Livery					83 00	
Stationery and printing					12 25	
Postage					44	
Telephone and telegraph					1 85	
Miscellaneous					170 39	
						620 38
Total						$5,432 80

Highway Improvements, Maintenance Account.

(Chapter 115, Laws 1898, and Chapter 293, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Henry C. Allen	Resident engineer	....	$2,400 per yr.	$7 69	$0 20	$7 89
L. K. Devendorf	Rodman	2	3 50 per day	7 00	3 71	10 71
						$18 60
Incidental Expenses.						
Labor					$2 00	
Livery					2 00	
						4 00
Total						$22 60

Summary.

Items	Authorized by		Amounts.	Totals.
	Chap.	Laws.		
Ordinary Repairs.				
Erie Canal	418	1900	$6,756 28	
Oswego Canal	418	1900	567 12	
Black River Canal	418	1900	253 97	
Cayuga and Seneca Canal	418	1900	448 88	
				$8,026 25
Extraordinary Repairs.				
Erie Canal.				
Richmond Aqueduct	311	1900	$19 57	
Fence around Geddes Basin	347	1901	41 83	
Black River Canal.				
Repairing Wells Brook Aqueduct	311	1900	569 96	
Rebuilding Pitcher's waste-weir	311	1900	394 12	
Improving locks, Black River Canal	311	1900	268 11	
Inserting pipes at South Lake	347	1901	399 08	
				1,722 67
Special Appropriations.				
Improving harbor, Canandaigua Lake	218	1900	$22 14	
Bridges at Montezuma	224	1900	303 72	
Continuing new road, Indian Reservation	645	1901	21 80	
Brasher Falls dam, St Regis River	645	1901	150 30	
Erie Canal.				
Washington street bridge, Utica	397 402 537	1898 1900 1900	765 23	
Schuyler street bridge, Utica	427 417	1898 1900	557 42	
George street bridge, Rome	625 572 417 454	1898 1899 1900 1900	1,000 00	
Peterboro street bridge, Canastota	626 417	1898 1900	79 33	
Catherine street bridge, Syracuse	424 547	1898 1900	845 49	
Foreman street bridge, Cazenovia	437	1900	911 00	
Completing bridge at inlet, Otisco Lake	387 417	1900 1900	186 24	
Improving Limestone Creek	419	1900	127 89	
Repairing wall at Skaneateles	419	1900	35 46	
Repairing sea walls, Owasco Lake	419	1900	16 38	
Oswego Canal.				
Filling north side cut, Spring street, Syracuse	645	1901	62 15	
Raising Oswego dam, Oswego River	645	1901	60 65	
Raising High dam, Oswego River	645	1901	30 53	
Raising Minetto dam, Oswego River	645	1001	82 50	
Repairing bridge over Oneida River at Three River Point	445	1900	183 15	
				5,341 38
Cayuga and Seneca Canal.				
Guard lock, etc., regulating Seneca Lake	680	1900	$3,078 05	
Extending towpath, Geneva	662	1900	1,587 70	
Bridge at Seneca Falls	224 396	1899 1900	517 46	
Dredging inlet and repairing pier, Cayuga Lake	645	1901	170 00	
Abutments, bridge at Penn Yan	455	1900	475 70	
Repairing approach, Liberty street bridge, Penn Yan	681	1901	24 88	
				5,853 74
Black River Canal.				
Bridge at Pratt's Landing, Black River	670 645	1900 1901	....	154 40

Summary—(Concluded).

ITEMS.	Authorized by Chap.	Authorized by Laws.	Amounts.	Totals.
SPECIAL SURVEYS.				
Surveys for Court of Claims	419	1900	$2,518 61	
Barge Canal survey, Erie Canal	411	1900	4,374 92	
				$6,893 53
Highway improvements	115 569 419	1898 1899 1900	$5,433 80	
Highway improvements, maintenance account	115 293	1898 1900	22 60	
				5,456 40
Total abstracts rendered during fiscal year				$33,448 37

TABLE No. 2.

Statement of Contracts in Force September 30, 1901.

NAME OF CONTRACTOR.	Date of contract.	Character of work.	Act. Chap.	Act. Laws.	Engineer's estimate.	Engineer's estimate at contract prices.	Payments to September 30, 1901.
John R. Y. Craigie and Stephen Maggio.	Sept. 12, 1900	Guard lock, etc., Seneca Lake outlet	680	1900	$76,440 00	$66,573 00	$35,258 00
American Bridge Co.	Aug. 28, 1900	Bridge over Seneca River near Rumsey street, Seneca Falls	224, 398	1899, 1900	12,765 00	6,684 00	3,876 00
Havana Bridge Works	April 12, 1899	Lift Bridge at Schuyler street, Utica	427, 417	1898, 1900	10,000 00	10,480 00	8,517 00
Havana Bridge Works	Oct. 11, 1900	Lift Bridge at Catherine and Almond streets, Syracuse	424, 547	1898, 1900	13,530 70	19,974 50	16,286 00
Havana Bridge Works	Oct. 19, 1900	Lift Bridge at Washington street, Utica	397, 409, 537	1898, 1900, 1900	22,864 00	23,100 20	18,462 00
William H. Welch	Oct. 4, 1900	Excavating and deepening the harbor and channel and the entrance at the foot of Canandaigua Lake	218	1900	7,875 00	7,831 25	....
American Bridge Co.	Aug. 8, 1901	Pratts Landing bridge over Black River	670, 645	1900, 1901	14,500 00	16,790 00	2,295 00
A. F. Chapman & Co.	Oct. 6, 1900	Constructing and extending the tow-path at Geneva	662	1900	38,125 00	30,822 50	25,262 00

TABLE No. 3.

Statement of Contracts Completed and Settled During the Fiscal year.

NAME OF CONTRACTOR.	Date of contract.	Character of work.	Act. Chap.	Act. Laws.	Appropriation.	Engineer's estimate.	Final account.
Henry Tosh	July 28, 1900	Bridges across Seneca and Canandaigua Rivers, near Montezuma	224	1900	$8,000 00	$7,299 00	$7,206 05
Havana Bridge Works	May 31, 1899	Lift Bridge at Peterboro street, in Canastota	626 417	1898 1900	18,000 00	15,318 75	15,933 08
Owego Bridge Company	Aug. 15, 1900	Bridge at South George street, Rome	625 572 417 454	1898 1899 1900 1900	18,000 00	12,814 25	11,631 79
John Kelly & Co	Oct. 3, 1900	Foreman Street Bridge, Cazenovia	437	1900	*15,000 00	7,596 00	7,073 21
John R. Briggs	Oct. 31, 1900	Repairing abutment, etc., to Liberty street bridge at Penn Yan	455	1900	4,500 00	3,714 50	3,315 21
John Kelly & Co	Oct. 16, 1900	Repairing towpath bridge at Three River Point	445	1900	*10,000 00	3,623 50	2,193 49
Wilkes D. Dodge	Dec. 20, 1900	Repairing Wells Brook Aqueduct, Black River Canal	311	1900	†	4,900 00	2,935 31
Wilkes D. Dodge	Dec. 3, 1900	Rebuilding Pitcher's Waste-weir, Black River Canal	311	1900	†	2,250 00	1,510 84

* Other work to be done from this appropriation. † Appropriated out of extraordinary repair fund.

TABLE No. 4.

Statement of Contracts for the Improvement of Public Highways in Force September 30, 1901.

(Chapter 115, Laws 1[illegible] Chapter 550, Laws 1899.)

CONTRACTOR.	Date of contract.	Character of work.	* Engineer's preliminary estimate.	Contract price.	Payments to September 30, 1901.
Town of Truxton	July 16, 1901	Cuyler Road No 40.	$2,810 00	$2,420 00	$1,028 08
Chambers & Casey	Aug. 12, 1901	Chenango River Road, No. 47	16,200 00	15,980 00	3,355 80

* Includes engineering and inspection.

TABLE No. 5.

Statement of Contracts for the Improvement of Public Highways Completed and Settled during the Fiscal Year ending September 30, 1901.

(Chapter 115, Laws 1898; Chapter 569, Laws 1899.)

CONTRACTOR.	Date of contract.	Character of work.	Engineer's preliminary estimate.*	Contract price.	Final account.
Edward Martin and James Martin	July 6, 1900	ak	$10,487 33	$9,050 00	$9,050 00
Clark & Hibbard	July 6, 1899	et	4,831 84	4,375 00	4,375 00
Clark & Hibbard	Sept. 21, 1899	y (. 8	7,525 00	6,828 00	6,828 00

* Includes engineering and inspection.

TABLE No. 6.

Water Records of Cayuga and Cross Lakes and Seneca River, Continued.

(See State Engineer's Report for 1900 for previous records.)

LOCATION.	1900.		1901.		1901.		1901.		Remarks.
	DECEMBER 7 AND 8.		MARCH 4 AND 5.		SPECIAL APRIL 17 AND 18.		AUGUST 6 AND 7.		
	WATER.		WATER.		WATER.		WATER.		
	Surface.	Depth.	Surface.	Depth.	Surface.	Depth.	Surface.	Depth.	
Cayuga Lock	— 7 736	11.35	— 9.258	9.8	— 5.803	....	— 7.358	11.90	Depth on lower mitre sill of lock.
Mud Lock	— 7.854	11.37	— 9.181	10.0	— 6.014	....	— 7.531	11.7	Depth on lower mitre sill of lock.
Seneca River Aqueduct	— 6.501	9 9	—11.301	7.1	— 7.271	....	—11.301	4 0	Depth on aqueduct foundation.
Canandaigua River, north of canal	— 9 116	8.54	—11.348	6.5	— 7.274	....	—11.426	6.2	Depth of river.
Canandaigua River, south of canal	— 8 770	8 8	—11.440	5.6	— 7.07	....	—10.71	6.8	Depth of river.
West Shore crossing	— 9 649	5.92	—11.699	4.0	— 7.869	....	—11.979	6.3	Depth on natural bed.
l crossing	—10 017	7.4	....	....	— 7.75	....	—12.566	4.6	Depth on bridge foundation.
....	—11.746	4 3	—14.396	1.9	— 8.536	....	—15.041	6.0	Depth in channel.
....	—12.979	21.6	—15 559	19.0	—10.091	....	—16.799	21.6	Depth at iron bridge.

REPORT

OF THE

DIVISION ENGINEER

OF THE

WESTERN DIVISION

For the Fiscal Year Ending September 30, 1901.

WESTERN DIVISION.

ROCHESTER, N. Y., *October* 1, 1901.

HON. EDWARD A. BOND, *State Engineer and Surveyor, Albany, N. Y.:*

Dear Sir.—I have the honor to submit the following annual report of the Western Division for the fiscal year ending September 30, 1901, divided for convenience into canal and special appropriation work, and highway improvement.

CANALS AND SPECIAL APPROPRIATION WORK.

The waterways upon this division consist of 152.01 miles of canals and slips and 32.45 miles of unnavigable slips and feeders, remaining the same as reported a year ago. The structures other than those particularly mentioned remain the same. The reports of the last three years contain tables of the various structures and their principal dimensions, for which reason they are not here repeated.

The past year has been a fortunate one on this division in that no serious breaks have occurred to delay navigation.

EXTRAORDINARY REPAIRS.

During last winter a considerable amount of betterment of the structures and walls was made under chapter 311, Laws of 1900, contracts having been made for the following work which was executed under the engineering supervision of this department:

CONSTRUCTING BRIDGE NO. 144 OVER THE ERIE CANAL AT VERNON STREET, MIDDLEPORT, NIAGARA COUNTY, N. Y., WHICH IS 31 MILES EAST OF TONAWANDA; ALSO BRIDGE NO. 183 (KNOWN AS THE THREE-MILE BRIDGE), OVER THE ERIE CANAL, ABOUT TWO AND ONE-HALF MILES WEST OF TONAWANDA, ERIE COUNTY, N. Y.

Chapter 311, Laws of 1900.

The King Bridge Co., contractors.

Plans approved by canal board	Dec. 27, 1900
Contract dated	March 1, 1901
Contract to be completed	June 15, 1901
Work begun	July 12, 1901
Contract completed	Sept. 10, 1901

Appropriation—Extraordinary Repairs.

Engineer's estimate	$5,107 00
Contract price	4,540 00
Final estimate	4,478 68

G. O. House, assistant engineer in charge.

The work covered by this contract consisted in the removal of the old timber superstructures at the sites of bridges 144 and 183, and the erection of new steel trusses in their place; the alteration of the substructure and planking of the new superstructures being done by the Department of Public Works.

Vernon Street bridge No. 144, Middleport, consists of a riveted pony Warren truss 102 feet 10 inches center to center of end piers, 104 feet 10 inches over all; 17 feet 3 inches center to center of trusses, 15 feet clear width of roadway between wheel guards, the trusses being 8 feet 6 inches center to center of chords. The trusses are divided into sub-panels by verticals carrying the floor beams hung from the panel points of the upper chords. The north approach has a short opening for which is provided a 15-inch "I" beam, span 22 feet 7½ inches in the clear. The skew of both spans is 21 degrees 32 minutes.

Three Mile Creek bridge No. 183 consists of a bridge of the

same type as bridge No. 144, and was built under the same conditions, the dimensions being 86 feet 6 inches center to center of end piers, 88 feet 7 inches over all; 17 feet 3 inches center to center of trusses; 15 feet clear width of roadway between wheel guards; 8 feet 6 inches center to center of chords.

Both of these bridges were erected upon the old trusses, obviating the use of false work, the erection being carried on in a workmanlike and efficient manner.

REBUILDING A WASTE-WEIR AND SPILLWAY ON THE ERIE CANAL AT ALBION, ORLEANS COUNTY, N. Y.

Chapter 208, Laws of 1899; chapter 311, Laws of 1900.

Baker & Judson, contractors.

Plans approved by the canal board	Oct.	22, 1900
Contract dated	Nov.	23, 1900
Contract to be completed	April	1, 1901
Work begun	Dec.	26, 1900

Appropriation—Extraordinary Repairs.

Engineer's estimate	$7,878 80
Contract price	6,753 50
Final estimate	7,026 40

Fred W. Hamilton, rodman in charge.

The old structure at this site consisted of a masonry spill-wall between the canal and the millpond, a masonry bulkhead over the culvert with three timber gates and masonry walls around the sides of the culvert well. The plans for this work originally contemplated the reconstruction with masonry; however, the lateness of the season made it difficult, if not impossible, to secure suitable stone, and under an agreement dated December 10, 1900, concrete was substituted for masonry.

The present structure is provided with three 24-inch sluice gates wasting from the canal to the culvert well and two 36-inch sluice gates wasting from the millpond to the culvert

well. A spillway 62 feet long was built between the canal and the pond and the walls surrounding the well on the pond side were so constructed as to make a spillway from the pond to the well. A 36-inch sluice gate connects the canal and the pond through the canal spillway.

By agreement dated April 22, 1901, extra work was provided in the furnishing of a timber fender along the breast wall and spillway; and also provision for Medina stone block paving at each side of the draft-gate to prevent scouring of the foundation.

THE CONSTRUCTION OF NEW SUPERSTRUCTURES AT STARKWEATHER'S BRIDGE NO. 132, WATSON'S BRIDGE NO. 147, WAKEMAN'S BRIDGE NO. 154 AND CADY STREET BRIDGE NO. 160.

Chapter 311, Laws of 1900.

American Bridge Co., contractors.

Contract dated	Aug. 13, 1900
Contract to be completed	Nov. 1, 1900
Work begun	Jan. 3, 1901
Work completed	March 30, 1901

Appropriation—Extraordinary Repairs.

Engineer's estimate	$11,306 64
Contract price	11,143 10
Final estimate	11,023 89

These bridges consist of steel riveted Warren pony trusses of 17 feet center to center of trusses, 8 feet center to center of chords and of the following lengths center to center of end pins: Cady street, 90 feet, Watson's and Starkweather's, 96 feet 8 inches, and Wakeman's 100 feet. These bridges replaced former wooden structures, all of which had decayed and become dangerous. Necessary changes in the masonry to adapt it to the new superstructures, as well as providing and laying the plank floors, were done by the forces of the Department of Public Works.

The cost of metal compares so favorably with that of timber superstructures (greater capacity and durability being considered), that the continued use of bridges of this type seems advisable for highways crossing the canals.

The forces of the Department of Public Works were given such engineering aid as was required in constructing the following named works:

Concrete vertical wall along both sides of the Genesee Valley feeder 443 feet in length and 9.5 feet in height.

Concrete facing to vertical wall on berme bank between Chapel and Exchange streets, Lockport, 438.5 feet, to prevent leakage into adjoining cellars.

Vertical wall laid in Portland cement along towpath from a point 78 feet westerly of Adams street bridge, Lockport, 1,262 feet easterly.

Vertical wall laid in Portland cement, with concrete coping along towpath between Batavia and Ingersoll street bridges, Albion, 11 feet high and 948.6 feet long.

Vertical wall on the east and south sides of Lockport waste weir No. 24.

Raising slope wall 2.5 feet along towpath from Change bridge No. 87, Rochester, 6,403 feet westerly.

Raising slope wall 1.25 feet along towpath from Drake's bridge No. 60 westerly 2,137 feet, together with 60 feet of vertical wall under bridge No. 60.

Vertical wall under Brailey's bridge No. 125, consisting of 50 lineal feet of vertical and 66 feet of twist wall.

Vertical wall at McCarty's bridge No. 116.

Dry vertical wall along towpath west from Knowlesville bridge No. 135, 117 lineal feet.

Slope wall on berme bank from Change bridge No. 87, Rochester, 255 feet easterly.

Vertical wall in Portland cement at Gaines Basin bridge No. 130, 261.5 feet in length.

Dry vertical wall along berme bank, beginning 260 feet west of Smith street bridge No. 109 and running westerly 200 feet.

Dry vertical wall on berme bank 400 feet from Ingersoll street bridge No. 127, Albion.

Dry vertical wall 500 feet easterly of Hall's bridge No. 126.

Vertical and twist walls in Portland cement under Lattin's bridge No. 129.

Slope wall 300 feet west of Gaines Basin bridge No. 130.

Slope wall 1,200 feet west of Allen's bridge No. 133.

Slope wall 400 feet west of Lattin's bridge No. 129.

Slope wall along towpath easterly from Cooley's Basin bridge No. 106.

Slope wall along towpath west from Adams Basin.

Slope wall along towpath 800 feet east of Gaines Basin bridge No. 130.

New concrete berme abutment, Albion swing bridge No. 128.

New masonry berme abutment, Bidwell's bridge No. 124.

Rebuilding berme abutment, Spencerport bridge No. 99.

Strengthening berme abutment, South St. Paul street bridge No. 68, Rochester.

Repairs to abutments, Holly bridge No. 115.

Rebuilding of abutments of Starkweather's bridge No. 132.

Watson's bridge No. 147, Wakeman's bridge No. 154 and Cady street bridge No. 160, for new steel superstructures.

Repairing leak at towpath end of culvert No. 38, Brighton.

Repairs to culvert No. 7.

Rebuilding ends of culvert No. 50, Spencerport.

Repairs to locks Nos. 53, 55, 56, 57, 58, 59, 63, and 64.

Repairs to waste-weirs 1, 3, 14 and 17.

During the summer the work of raising banks, topping out slope and vertical walls, gravelling walls and repairing head walls of culverts has been carried on by the forces of the Department of Public Works and the physical condition of the canal materially improved, especially the towpath, which is generally in excellent condition, particularly on section No. 8.

The experiment is being made of topping out the slope walls for about 3 feet in height with broken sandstone, crushed in the Medina district by the State plant and boated to the work. Quarry spawls are used at little expense except for crushing and transportation. Should the experiment prove as successful as expected this will prove an inexpensive plan of maintaining the slope walls.

DEEPENING AND IMPROVING MUD CREEK AND ITS TRIBUTARIES, IN NIAGARA COUNTY, N. Y.

Chapter 572, Laws of 1899.

Frank J. Levalley, contractor.

Contract dated	July	26, 1900
Contract to be completed	Nov.	1, 1900
Work begun	Aug.	1, 1900
Contract completed	Aug.	10, 1901
Appropriation		$10,500 00
Engineer's estimate		8,174 20
Contract price		8,582 91
Final estimate		8,582 70

Thad L. Wilson, rodman, in charge.

The work contemplated by this contract consisted in the continuance of the cleaning of Mud creek and the excavating of the channel, being an extension of the work done under chapter 307, Laws of 1895, 477 of the Laws of 1896 and 552 of the Laws of 1898, extending over a length of 20,100 feet. A channel with 20 feet bottom width with 1 to 1 slopes was provided.

The plans contemplated both the cutting off of bad bends by a changed alignment and the cleaning out of the present creek so that if proper releases could be obtained from the property holders a new alignment in many places could be provided economically, as well as adding to the efficiency of the run-off of the stream. However, few of these cuts were made, owing to the opposition of the property holders, many of whom saw their error after the completion of the work across their farms.

As the result of the portion of the work done during the season of 1900 the waters have run off much faster and the benefit of the improvement has been apparent to the contiguous populace. Owing to delays by the contractor this work was not completed until the date above mentioned.

BUILDING A TWO-SPAN STEEL BRIDGE WITH NECESSARY ABUTMENTS, PIERS, APPROACHES AND CREEK PROTECTION AT CLEAR CREEK, CATTARAUGUS INDIAN RESERVATION.

Chapter 569, Laws of 1899, and chapter 419, Laws of 1900.

Berlin Iron Bridge Co., contractors. (Assigned to American Bridge Co.)

Contract dated	Oct.	26, 1900
Contract to be completed	Jan.	24, 1901
Work begun	Jan.	14, 1901
Contract completed	June	25, 1901
Appropriation		$6,600 00
Engineer's estimate		4,778 00
Contract price		5,036 00
Final estimate		4,892 83

Tracy B. Smith, rodman, in charge.

This work consisted in the removal of two 65-foot timber spans across Clear creek, on the road between Irving and Lawtons, about 1 mile west of the Thomas Orphan Asylum, and replacing them with two steel pony truss spans, 65 feet over all, having a clear width of roadway of 15 feet, together with new concrete abutments and center pier. The old substructure consisted of a poor rubble masonry west abutment and pile center pier and east abutment, all very much dilapidated.

The plans contemplated the founding of the substructure on a stratum of gravel, but excavation developed an underlying bed of quicksand, making necessary the use of a pile foundation, of which such of the old piles as could be cut off and be suitable were used. The brush protection to the east approach which was contemplated in the original plan had to be omitted

and gravel embankment only used, owing to lack of appropriation and the necessity of the pile foundation. Considerable trouble and delay was entailed in getting the foundation in place, owing to the quicksand and large logs embedded therein making it difficult to build water-tight cofferdams.

CONSTRUCTING A WASTE-WEIR AND SPILLWAY ON THE ERIE CANAL AT SPENCERPORT, N. Y., 185 FEET EASTERLY OF CULVERT NO. 47.

Chapter 201, Laws of 1900.

W. E. Flanigan, contractor.

Plans approved by Canal Board	Oct.	22, 1900
Contract dated	Dec.	4, 1900
Contract to be completed	April	1, 1901
Work begun	Dec.	18, 1900
Contract completed	April	9, 1901
Appropriation		$6,000 00
Engineer's estimate		2,013 00
Contract price		1,310 40
Final estimate		1,386 22

Tracy B. Smith, rodman, in charge.

On May 9, 1899, the waste-weir known as the Spencerport waste-weir, located on the berme side about 800 feet easterly of culvert No. 47, failed, doing considerable damage. Chapter 201, Laws of 1900, provided for a new waste-weir on the towpath side.

Borings at available sites indicated the presence of a treacherous foundation, largely composed of quicksand, making the least possible disturbance of the towpath advisable, as well as requiring the design for a structure producing a small bearing pressure on the foundation.

The design adopted, while radically differing from any other waste-weir and spillway on the canals, is simple in its details, economical and facile of construction, and obviates the necessity for disturbing to a great extent the old banks, and hence

minimizes in a large measure danger from leaks when water is first let in against the new structure.

The waste-weir consists of a 24-inch cast iron pipe fitted with a gate valve of the same diameter, operated by means of gearing from a standard at the back angle of the canal, where it is out of the way of navigation. The discharge at the foot of the towpath slope is into a suitable ditch paved with stone blocks and concrete, which conducts the water to creek, riprap at the creek being provided as a precaution against scour. A concrete slope wall is provided with an opening 10 feet long over which the water spills into an oblong concrete well and is discharged into the waste-weir pipe through a tee back of the valve. An I-beam and buckle plate floor equipped with suitable manhole for inspection carries the gravel towpath over the spill well, leaving the towpath unobstructed in any manner. Suitable cut-off walls of concrete and sheet piling are provided.

The entire cost, inclusive of inspection and advertising, was but about one-third of the appropriation. It is confidently expected that the points of merit of this design will greatly outweigh the only criticism yet made, namely the slowness of operation of a gate with screw stem.

THE CONSTRUCTION OF A CULVERT OVER THE STATE DITCH AT THE INTERSECTION OF THIRD AVENUE AND IRONTON STREET IN THE CITY OF NORTH TONAWANDA, NIAGARA COUNTY, N. Y.

Chapter 423, Laws of 1900.

Rudolph & Gatty, contractors.

Plans approved by Canal Board	July 16, 1900
Contract dated	Sept. 4, 1900
Contract to be completed	Dec. 1, 1900
Work begun	Sept. 17, 1900
Work finished	Dec. 15, 1900
Appropriation	$3,500 00
Engineer's estimate	2,860 00
Contract price	1,984 80
Final estimate	1,757 85

Tracy B. Smith, rodman, in charge.

This structure is, as the title of the bill indicates, at the intersection of Third avenue and Ironton street in the city of North Tonawanda, N. Y., and replaces an old plank bridge of 16 feet span and 12 feet width formerly located at this site. The structure consists of a concrete arch of 4 feet radius with 1 foot bench walls on a concrete foundation extending across the entire width of the ditch, the object of this being to reduce the earth pressure, owing to the treacherous foundation, thus making a floating foundation. The structure is 115 feet along the center line, with parapet walls on the westerly side of Ironton street and the northerly side of Third avenue, and covers the entire street widths.

The plans contemplated the raising of the grades of these streets to the grade adopted by the city of North Tonawanda, who were to have improved these streets during the past summer; however, they failed to do so, but sufficient filling was put in to properly cover the structure, as had the grade been brought to the height shown by the plans (owing to the failure of the city to raise the remainder of the street) would have left the approaches unsightly.

Owing to misunderstandings on the part of the contractors, certain brush washing was omitted and under an agreement dated December 18, 1900, a reduction of $25 was made in their contract price. Other than as above noted the culvert has been built in accordance with the plans.

THE IMPROVEMENT OF THE SENECA LAKE LEVEL OF THE CHEMUNG CANAL AND THE REPAIRING OF THE DOCKING ALONG THE CHANNEL OF GLEN CREEK IN THE VILLAGE OF WATKINS, SCHUYLER COUNTY, N. Y.

Chapter 447, Laws of 1900.

Edward J. Hingston, contractor.

Contract dated	Oct.	18, 1900
Contract to be completed	Dec.	1, 1900
Work begun	Oct.	27, 1900

Work completed .... Feb.	6. 1901
Appropriation	$5.000 00
Engineer's estimate	2.785 75
Contract price	3.400 00
Final estimate	4.192 06

T. W. Barrally, assistant, in charge.

The work done under this contract consisted in dredging bars from the channel of the Chemung canal opposite the junction with Glen creek and also about 600 feet southerly of Glen creek, the excavated material being used to repair the adjoining towpath, and the repair of the pile dyking on both sides of Glen creek, from the Chemung canal to the Northern Central railway bridge.

This piling has been built under various acts of the Legislature and has yearly required very considerable repairs, owing to the short life of timberwork under the conditions here existing.

During November, 1900, a freshet occurred which damaged portions of the pile protection of Glen creek not covered by the plans. Under an agreement dated December 13, 1900, the balance of the appropriation was expended in repairing this damage as far as the funds available would permit.

CLEARING OUT AND IMPROVING THE WEST BRANCH OF EIGHTEEN-MILE CREEK, IN THE TOWNS OF LOCKPORT AND NEWFANE, IN THE COUNTY OF NIAGARA, N. Y.

Chapter 609, Laws of 1898, and chapter 151, Laws of 1900.

I. M. Ludington, contractor.

Plans approved by Canal Board .... July	16. 1900
Contract dated .... Oct.	17. 1900
Contract to be completed .... Jan.	1. 1901
Work begun .... Oct.	17. 1900
Contract completed .... June	22. 1901
Appropriation	$15.[illegible] 00
Engineer's estimate	12.946 82
Contract price	[illegible]
Final estimate	[illegible] 35

E. V. R. Payne, leveler, in charge.

Eighteen-Mile creek, running northerly from Lockport to Lake Ontario, is used as the outlet for waters taken from the Erie canal at Lockport, and at certain seasons in the year sudden rises in the level of the water causes a breaking up of the ice, which gorges at the sharp bends, entailing a flooding of the lowlands from backwater.

Owing to the tortuous course of the stream, after considerable study and investigation, cut-offs were planned at the worst bends, thus straightening the channel, and three bridges of small span which contracted the channel were removed and replaced with new timber superstructures on concrete foundations, providing a clear opening of 60½ feet. Owing to the great expense of putting a dredge into the creek and the distance between cuts, making the moving of a dredge costly, shallow cuts which could be made dry and of a suitable width were planned rather than deep cuts of less width, which thus gave a greater surface area and hence less liability of the ice clogging.

Owing to the lateness of the season when this work was started and the large volume of water in the creek, progress of the work has been very much delayed.

THE CONSTRUCTION OF A DYKE ALONG A PORTION OF THE SOUTH BANK OF THE CHEMUNG RIVER IN THE CITY OF ELMIRA, N. Y.

Chapter 231, Laws of 1900.

Pulford & Clark, contractors.

Contract dated	Oct.	11, 1900
Contract to be completed	Dec.	1, 1900
Work begun	Oct.	17, 1900
Contract completed	April	27, 1901
Appropriation		$10,000 00
Engineer's estimate		7,313 00
Contract price		7,872 00
Final estimate		7,637 47

T. W. Barrally, assistant engineer, in charge.

The work done under this contract consisted in the construction of a stone slope wall on the southerly side of the Chemung river, from the Madison avenue bridge westerly to a point about 190 feet easterly of Lake avenue bridge, where it connects with an old vertical wall. The stone wall extends to an elevation of 850 feet above mean tide, upon which is constructed an earth embankment 8 feet in width on top with suitable slopes, to an elevation of 854, being about 1 foot above extreme high water of the Chemung River. Between Lake avenue and Main street bridges the old pile dyke was rebuilt where necessary with oak piles 30 feet long and 5 feet center to center, backed with 3-inch oak plank and capped at an elevation of 854, upon which was built an earth dyke similar to the one topping the stone slope wall.

The life of piles in these structures is short, as is evidenced by the early failure of previous work of this nature by the State on the opposite side of the river, which made the use of a stone slope wall advisable where the work was entirely new, but the limited amount of the appropriation would not permit of other than repairing the old structure where it existed.

THE PROTECTION OF A PORTION OF THE EAST BANK OF THE CHEMUNG RIVER IN THE TOWN OF CORNING, STEUBEN COUNTY, N. Y.

Chapter 441, Laws of 1900; chapter 645, Laws of 1901.

Harry Beardsley, contractor.

Contract dated	Oct. 19, 1900
Contract to be completed	March 1, 1901
Work begun	Oct. 27, 1900
Work completed	
Appropriation	$4,300 00
Engineer's estimate	3,379 [illegible]
Contract price	3,198 79
Estimate of work done	3,322 [illegible]

T. W. Barrally, assistant engineer, in charge.

The work done under this contract consisted in the construction of a dry slope wall 725 feet in length along the lands of James Flynn, Samuel Phenis, Barlow Gorton and William Gorton, about 1,300 feet southerly from what is known as the Gibson street bridge, Corning.

The purpose of this wall was to prevent the erosion of the banks by the waters of the river which are thrown against this bank by a small island opposite the work and in the middle of the river. The slope wall is founded upon a 12 x 12 hemlock toe-stick 2½ feet below average low water, the wall being 22½ feet high on the slope extending to high water, although not to extreme high water.

The reason why the amount of work exceeds the contract quantities is owing to the fact that during November, 1900, and during the construction of the work, a heavy flood washed out the bank, making it necessary to borrow material for the embankment, supplying the washed-out material as a foundation for the wall, the excess having been approved by the State Engineer by letter to A. J. Rockwood, Division Engineer, dated December 21, 1900.

After the supposed completion of this work and before final payment was made, a portion of the wall failed, and the writer has been endeavoring since to induce the contractor to make good his oft-repeated promises to remedy the defective work and complete the contract. At this writing it would appear that the Superintendent of Public Works will be obliged to terminate the contract and complete the work.

CONSTRUCTING A LIFT BRIDGE OVER THE ERIE CANAL AT WEST AVENUE IN THE CITY OF ROCHESTER, N. Y.

Chapter 549, Laws of 1899.

Havana Bridge Works, contractors.

Contract dated	Oct. 19, 1900
Contract to be completed	April 1, 1901
Work begun	Nov. 1, 1900

Appropriation	$75,000 00
Engineer's estimate of cost......................	67,294 00
Contract price	68,508 70
Estimate of work to October 1, 1901............	41,060 00

The design of this bridge is of a new and novel type, the principle of the Heinrichenburg lift-lock in Germany having been adapted to the purpose. The superstructure will consist of a 40-foot roadway and two 10-foot walks carried upon heavy riveted trusses of about 140 feet length, having curved upper chords of pleasing design. The skew of this bridge is nearly 45 degrees, complicating the floor system. The moving portion of the bridge is supported by posts attached to large rectangular immersed floats located in concrete-lined pits, the displacement of the floats being designed to just counterbalance the weight of the bridge, the only counterweight provided being about 8,000 pounds distributed at the four corners of the bridge to compensate for any lack of symmetry in the finished structure. Electric power will be used to operate the bridge.

With the hope that through an early start this bridge might be completed before the opening of navigation, I arranged with the Department of Public Works so that the removal of the old superstructure was begun prior to the closing of the canal a year ago. Work on the substructure was carried on promptly, but vexatious delays in the fabrication and erection of the superstructure have continued and the very large traffic at this point seriously inconvenienced. The completion of this bridge before the close of navigation now appears doubtful.

CONSTRUCTING A LIFT BRIDGE OVER THE ERIE CANAL AT CHAPEL STREET, IN THE CITY OF LOCKPORT, N. Y.

Chapter 573, Laws of 1899; chapter 16, Laws of 1900.

Havana Bridge Works, contractors.

Contract dated	April 24, 1900
Contract to be completed	April 1, 1901
Work begun	Nov. 14, 1900

Appropriation	$24,000 00
Engineer's estimate of cost	14,909 60
Contract price	18,915 00
Estimate of work done to October 1	18,360 00

In order that the work might progress as rapidly as possible, arrangements were made with the contractor whereby he removed the old abutments and approaches down to the water-line prior to the closing of the canal.

The bridge is of a lift type, as indicated by the title, the moving portion consisting of a riveted truss span 111 feet in length, providing a 20-foot roadway and two 6-foot walks, hung on cables passing over sheaves located in towers at the four corners and balanced by counterweights. This bridge differs from other lift-bridges upon this division in that the moving portion is balanced. Power through a water cylinder located upon the truss beneath the floor and supplied with water through telescopic pipes in the berme towers operates a rack and pinion and drives cables which are utilized to both raise and lower the bridge instead of to lower it only as is customary. This bridge is practically completed; the only work remaining consists of cleaning and adjusting of the bridge. While vexatious delays have occurred, the public has probably suffered little inconvenience.

CONSTRUCTING AN ARCH BRIDGE OVER THE ERIE CANAL AT PINE AND LOCK STREETS, IN THE CITY OF LOCKPORT, N. Y.

Chapter 430, Laws of 1900.

Niagara Construction Company, contractors.

Contract dated	Nov. 27, 1900
Contract to be completed	May 1, 1901
Work begun	Dec. 28, 1900
Appropriation	$75,000 00
Engineer's estimate of cost	64,743 00
Contract price	51,769 80
Estimate of work done to September 30, 1901	40,100 00

The plan for this bridge contemplated the construction of a ribbed steel-arch skew bridge, 164 feet center to center of end pins supporting a roadway 40 feet in width of buckle-plate construction, having a brick pavement upon concrete foundation, and two sidewalks 13 feet in width, of concrete reinforced with "expanded metal." New masonry-faced concrete abutments have been built, considerable difficulty having been encountered on the berme side owing to the hydraulic race adjoining and the necessity of altering the intake of the city wafer-works. The masonry is nearly completed and the condition of the steel-work warrants the hope that it will be completed before the close of this season.

CONSTRUCTING A STEEL FOOT BRIDGE OVER THE ERIE CANAL AT LYELL AVENUE IN THE CITY OF ROCHESTER, N. Y.

Chapter 645, Laws of 1901.

American Bridge Company, contractors.

Contract dated	July	30, 1901
Contract to be completed	Nov.	1, 1901
Appropriation		$3.000 00
Engineer's estimate of cost		2,704 00
Contract price		2.427 50

The plans provide for an overhead foot-bridge just east of Lyell avenue lift bridge to accommodate the considerable foot traffic when the bridge is raised. The employees of the numerous industries near this site find the delays incident to the lift bridge being raised a hardship. Two 100 foot plate girders 64½ inches high spaced 8 feet center to center, supported by steel towers upon concrete piers and supplied with suitable stairways, are provided. The masonry has been constructed by the forces of the Department of Public Works and the steel work is now in process of manufacture at the Rochester plant of the contractors.

Plans and estimates of cost have been prepared for the masonry substructure of the following bridges to meet the require-

ments of superstructure plans prepared by the Bridge Department:

Ferry street bridge, Buffalo, chapter 618, Laws of 1899, and chapter 696, Laws of 1901.

Cattaraugus creek bridge, Versailles, chapters 685, Laws of 1901, and Ohio street bridge, over the Clark and Skinner canal, Buffalo, chapter 695, Laws of 1901.

DRAINAGE OF CONEWANGO CREEK IN THE TOWNS OF POLAND, CARROLL AND KIANTONE, CHAUTAUQUA COUNTY, N. Y.

Chapter 448, Laws of 1900.

Appropriation	$35,000 00

Plans, specifications and estimates of cost for the construction of cut-offs or diversions in the channel of this creek, as well as for the sub and superstructure of a bridge across the proposed Dolloff cut have been furnished to the Commission entrusted with the carrying out of this work during the past year. Inasmuch as the provisions of the act only provide for furnishing the plans, there is no knowledge of what progress has been made with the construction.

CONSTRUCTION OF A VERTICAL WALL ON THE SOUTH SIDE OF THE ERIE CANAL, IN THE VILLAGE OF EAGLE HARBOR, ORLEANS COUNTY, N. Y.

Chapter 686, Laws of 1901.

Appropriation	$3,000 00
Engineer's estimate of cost	3,288 75

Plans for this work have been approved by the Canal Board and the work is now being advertised contemplating the construction of 350 feet of concrete vertical wall in place of the defective stone wall now at this site. The work is to be done during the coming winter.

IMPROVEMENT OF GLEN CREEK, BETWEEN THE NORTHERN CENTRAL RAILWAY AND THE CHEMUNG CANAL, IN THE VILLAGE OF WATKINS, SCHUYLER COUNTY, N. Y.

Chapter 699, Laws of 1901.

Appropriation	$6,057 83
Engineer's estimate of cost	4,886 60

The appropriation for this work is for an unexpended balance from chapter 697, Laws of 1899, provided for the improvement of Watkins harbor.

A pile and earth dyke exists along the banks of this creek which, owing to the peculiar conditions, rots out very quickly the life of the timber, not exceeding three to four years. Repairs have been made under chapter 140, Laws of 1895, chapter 624, Laws of 1898, and chapters 418 and 447, Laws of 1900, the appropriations only being sufficient to make repairs, and not of ample amount to provide for any change of plan. It has been decided, in view of these facts, to plan a concrete faced earth dyke, as a much more durable and economical construction in the end, rebuilding upon a complete plan so much as the appropriation will permit of, and at such points as are most in need of reconstruction. This work is now being advertised, and it is hoped to complete it before cold weather.

ORDINARY REPAIRS.

All requests of the Department of Public Works for plans, surveys and other engineering work in connection with the ordinary maintenance have been met as promptly as conditions warranted.

COURT OF CLAIMS.

Progress has continued on surveys and preparation for trial by the Attorney General before the Court of Claims. Sessions of the court for trial of cases upon this division were held in Buffalo during the weeks of June 24th and September 9th such representation and records of this office as were requested being provided.

CANAL IMPROVEMENT.

Chapter 79, Laws of 1895, chapter 794, Laws of 1896; chapter 43, Laws of 1897; chapter 569, Laws of 1897.

During the past year hearings upon contract No. 5, Grannis & O'Connor, contractors, and contract No. 13, H. C. Allen & Co., contractors, were held by the Canal Board, and awards made. Trials before the Court of Claims of contracts 2, 7 and 8 were held, but judgments have not been rendered at this date.

BARGE CANAL SURVEY.

Chapter 411, Laws of 1900.

It was my pleasure to serve both James J. Overn, special resident engineer in charge, and Emil Kuichling, expert, whenever called upon, in furnishing data and other help from this office.

A boat inspection of the canal has been made this fall of the general conditions of the various structures on this Division by the division and resident engineers. Owing to water, an inspection of the wells and trunks of many of the culverts was impossible.

A detailed inspection of the bridge superstructures was not attempted, it being assumed that this will be done by the Bridge department.

The headwalls should be relaid at culverts Nos. 3, 10, 11, 22, 23, 41, 44, 46, 48, 51, 54, 57, 61, 63, 67, 68, 69, 70, 71, 72, 74, 76, 80, 81, 82, 83, 84, 85, 86, 87, 90, 91, 93, 97, 107, 109, 110, 111, 113, 115, 116, 119 and 120 on the north ends (the canal is assumed as running east and west), and at culverts Nos. 9, 10, 11, 16, 23, 24, 41, 46, 51, 52, 57, 63, 66, 67, 68, 72, 81, 83, 90, 93, 110, 111, 112 and 119 on the south ends.

The wings need relaying at culverts Nos. 5, 17, 18, 22, 23, 41, 44, 46, 48, 51, 54, 57, 63, 67, 68, 69, 70, 72, 74, 76, 80, 81, 82, 83, 84, 85, 87, 90, 91, 93, 97, 100, 104, 109, 110, 111, 112, 113, 115, 116, 119 and 120 on the north ends, and at culverts Nos. 4, 9, 12, 15, 16, 17, 23, 24, 37, 41, 46, 51, 53, 57, 63, 65, 67, 68, 72, 81, 83, 88, 90, 93, 109, 110, 111, 112, 114, 117, 119, 121 and 122 on the south ends.

The joints of the headwalls should be raked out and repointed at culverts Nos. 4, 6, 12, 13, 14, 15, 17, 18, 19, 24, 33, 52, 53, 77, 86, 103, 108, 112, 117, 118, 121 and 122 at the north ends and at culverts Nos. 3, 4, 6, 12, 13, 14, 15, 19, 20, 21, 35, 37, 43, 44, 48, 53, 55, 74, 77, 84, 85, 86, 91, 97, 100, 102, 108, 113, 114, 116, 117 and 120 at the south end.

The wells need cleaning out at culverts Nos. 6, 20, 46, 52, 66, 70, 73, 75, 82, 104, 108, 112 and 117 at the north ends, and 6, 29, 48, 52, 68, 70, 73, 74, 85, 89, 91, 97, 101, 104, 108 and 112 at the south ends, and the trunks of Nos. 32, 117, 119, 120 and 121, as well as probably all of the culverts with submerged trunks, and which could not be inspected.

Trees and other vegetation should be removed from the north end-walls of culverts Nos. 53, 61, 68, 69, 70, 103, 118 and 120, and from the south end-walls of culverts Nos. 18, 68, 74, and 104, and the ditches at the north end of culverts Nos. 41, 42, 44, 52, 75, 94 and 101, and the south end of Nos. 52, 66, 94, 116 and 119 require cleaning out.

The head-wall at the north end of culvert No. 10 should be rebuilt in the near future, as it is in danger of failure and the consequent stoppage of water from waste-weir No. 1, which would render this waste-weir situated on the low level and the last one on this division, inoperative. There is a considerable leak in the arch of culvert No. 38 about 25 feet from the north end.

Culvert No. 51 drips considerably; culvert No. 63 appears to have settled under the prism and should be pumped out and inspected. Culvert No. 65 drips considerably about 25 feet from the berme end. Culverts Nos. 73 and 76 are filled with quarry spawls. Culvert No. 115 has wooden trunk which is exposed to the air and under present conditions will soon rot out.

The towpath abutments of bridges Nos. 32, 79, 114, 167b, 178, 191 and 204, and berme abutments of bridges Nos. 19, 30, 32, 50, 59, 60, 68, 79, 125, 149, 166b, 166c, 167b, 167c, 170, both piers 178,

186 and 204, should be rebuilt, being in my judgment in a dangerous condition.

The wings of the abutments of the following bridges should be relaid. Towpath abutment east wings Nos. 33, 40, 47 and 105; west wings Nos. 33, 40, 47, 105 and 150. Berme abutment east wings, Nos. 29, 40, 42, 44, 48, 49, 57, 88, 97, 100, 105, 136, 137, 141, 146 and 153; west wings, Nos. 29, 40, 42, 44, 48, 49, 57, 88, 92, 96, 97, 100, 101, 102, 105, 112, 121, 136, 137, 141, 146, 151 and 153.

The following abutments need repointing: Towpath side No. 1, 2, 3, 6, 7, 18, 19, 20, 23, 30, 31½, 35, 36, 37, 38, 39, 40, 41, 42, 43, 45, 47, 48, 49, 50, 52, 53, 55, 56, 57, 58, 60, 64, 66, 67, 68, 70, 76, 80, 81, 92, 94, 95, 96, 97, 98, 99, 100, 101, 104, 106, 107, 109, 110, 111, 112, 117, 118, 119, 127, 135, 136, 139, 152, 153, 154, 166b, 167a, 169a, 176, 179, 180, 184, 187, 189, 194, 196½, 201, 202, 207, 211, 217, 218 and 219. Berme side, Nos. 2, 3, 6, 7, 11, 13, 18, 20, 23, 27, 29, 31½, 35, 36, 37, 39, 40, 43, 45, 47, 51, 52, 53, 55, 56, 62, 64, 66, 70, 76, 80, 81, 94, 95, 96, 98, 101, 102, 104, 106, 107, 109, 110, 111, 112, 117, 118, 119, 120, 122, 123, 127, 136, 139, 140, 150, 151, 152, 154, 156, 157, 164, 167b, 168c, 169a, 170, 174b, 176, 179, 180, 184, 187, 189, 191, 194, 196½, 202, 211, 217, 218 and 219.

The coping on the wing walls of the following abutments requires resetting. Much of it is sloping coping which has slid away. Towpath side Nos. 3, 8, 9, 11, 19, 21, 57, 60, 96, 110, 129, 136 and 138. Berme side, Nos. 1, 2, 3, 8, 9, 10, 21, 27, 28, 55, 58, 87, 88, 121, 123, 131, 138, 142, 143 and 148.

The entire superstructure on bridges Nos 12, 19, 28, 36, 44, 45, 46, 49, 52, 53, 55, 64, 65, 66, 67, 71, 73, 74, 75, 80, 81, 82, 83, 85, 86, 97, 113, 115, 116b, 118, 123, 125, 129, 135, 140, 140½, 141, 153, 184, 185, 186, 189, 189½, 192, 194, 210, 211, 217, 218, 219, 220, and the portion below the flooring on bridges Nos. 20, 21, 31, 33, 34, 35, 38, 39, 40, 48, 50, 62, 63, 67½, 84, 117, 126, 128, 137, 165, 175½, 177 require repainting and in many instances a thorough cleaning with wire brushes should precede the painting.

New trusses should be provided for bridges Nos. 1, 44, 57, 59,

118, 123, 166a, 166c, 167a, 167c, 171, 172, 180, 211, 212 and 219, while the sway bracing should be adjusted on bridges Nos. 5, 36, 52, 93, 108, 121, 122, 125, 127, 129, 157 and 179.

I believe that bridges Nos. 118, 120 and 125 are too light for the loads which are passing over them and would recommend an investigation of this matter by the Bridge Department.

No thorough inspection of the six stop gates upon this division could be made with the water in the canal, but indications pointed to their being in fair condition. The Medina, Palmyra and Lyons aqueducts all leak more or less through the masonry, particularly the former, which should be repointed, grout forced into voids and the vegetation removed from joints.

Waste-weir No. 2 requires cleaning out of outlet channel; No. 3 needs a new timber platform; No. 4, the steel bulkhead and waste-gates need cleaning and painting. While the masonry shows no leaks, the outlet stream would indicate that water is passing under the foundations. No. 5 needs pointing and closing of leaks in west wing. No. 7, steel bulkhead and gates require scraping and painting. One end of one of the "I" beams supporting floor has slipped from the pier. No. 14 is in bad condition and should be rebuilt and lowered so gates may drain canal, which has been deepened at this point. No. 15, seems to have a leak around masonry which could not be found owing to presence of timber flume. No. 16, at end of old canal Holley. This structure was repaired during 1900. (The condition of the old canal is such that no volume of traffic can utilize it. Were a spillway constructed across its junction with the present canal it would relieve the danger from breaks on the two high banks across which it passes). No. 17, at the springing line of each arch, grout should be pumped into existing voids. No. 19, spillway needs repointing and timber bulkhead and gates should be renewed. No. 20 is in very bad condition and should be rebuilt. No. 21, bulkhead and gates should be scraped and painted. No. 22, the breast wall leaks badly; east end has two considerable leaks; timber gates decayed.

should be rebuilt. No. 23, bulkhead needs repainting and retaining wall at end should be relaid.

The defects in locks requiring attention are as follows: No. 53, one new balance beam and repair of two paddles of tumble gate now out of use. No. 54, tightening of bottom of berme lock, which leaks badly when full, into adjoining cellar. No. 55, one new balance beam needed and the berme lock leaks badly, especially around its upper gates. No. 56, plank and railing of platform need renewing. Shaft of operating machinery needs leveling up with shims. No. 57, a few leaks in berme lock. No. 58, one new balance beam needed, berme lock leaks slightly. No. 59, a leak exists under tumble gate of the berme lock. Gate to adjoining dry dock in leaky condition. No. 62, there is a leak at east end of division wall and settlement of earth over same. A number of leaks exist in towpath lock. No. 63, walls of lengthened lock leak badly. No. 64, both locks leak somewhat. Tumble gate of berme lock should be overhauled. No. 65, the lengthened portion of the berme lock leaks badly. No. 66, one new balance beam needed. Wall between lock and dry-dock leaks badly. Nos. 67 to 71, several of the stone mitre-sills require renewing.

The State has abandoned the Hamburg canal to the City of Buffalo, which is constructing a large overflow sewer from the Hamburg sewer in same and filling-in the prism. The Ohio Basin slip and Clark and Skinner canals extend from the Hamburg canal to Buffalo river, and the closing of the Hamburg has stopped what little current formerly existed in them. Sewage and other refuse deposited in these two slips is rapidly filling up the channels and rendering them foul. The City of Buffalo is constructing a branch from the sewer in the Hamburg canal, to empty into the Ohio Basin slip. The usefulness of these slips for navigation has probably passed, and they should either be filled in and remove the necessity of rebuilding the now obsolete bridges carrying the streets over them, or some means provided of preventing them from becoming nuisances.

HIGHWAY IMPROVEMENT.

When my last annual report was submitted, three roads, namely, River road No. 23, Whites Corners road No. 2a and Orchard Park road, section 1, No. 27, were under construction, with every prospect of completion during the season. Bad weather prevented the completion of the first two of these until late in November, 1900, and they were only accepted by the State after a written agreement had been given by the contractors to remedy any defects which might appear during the winter, owing to the impossibility of their use by traffic 30 days prior to snow. These agreements were carried out and necessary slight repairs made in the spring of 1901. Inability of the contractors to secure stone (local) for the foundation course, combined with bad weather, prevented the contractors completing section 1 of the Orchard Park road until this season.

The scarcity of labor, abundance of work, eight-hour law and general prosperity have tended to increase prices and hence the cost of work over past years. As a consequence it has been necessary to raise estimates of cost and request increased appropriations from boards of supervisors to meet the county's share, resulting in delay in awarding the contracts for road construction begun during the current year until July, thus shortening the season during which construction may go on about two months.

STONE SUPPLY.

In the past the difficulty has been in securing a sufficient amount of trap rock, while this season delays have been caused through failure to secure limestone for foundation and screenings.

While an abundance of stone exists in or near the territory where construction is now going on, few plants are so equipped as to furnish stone as demanded by the specifications. Many crushers are scattered around at different points but few have suitable elevators and nearly all lack and will not procure a rotary screen, so essential to the proper sizing of the stone. At

present, unless the local stone used for foundation course is limestone, the product of the crusher under 1½ inches in diameter is a waste product. The use of this now waste product, after having been properly separated into the various sizes, thus reducing the cost of the work without in my opinion materially affecting the quality, is commended to your consideration.

A large plant is located at South LeRoy for crushing limestone, which owing to the satisfactory quality of the product, its location, and the prices which its large output enables it to quote, resulted in its selection as a source of supply by all the contractors having work on this division, for a portion at least of the limestone product required by them. Accidents and inclement weather resulted in a decreased output of the crusher and hence failure on the part of the quarrymen to supply to the railroad upon which their plant is located the amount of crushed stone called for by a contract with them, and as a consequence we, without warning, were cut off from our supply of stone through the appropriation by the railroad company of all stone loaded.

It has been difficult for the contractors to secure other stone on such short notice with the result that all of the work has been seriously delayed, so much so that Southport road, section 2, and the Fairport road, probably will not be completed this season.

In the Medina sandstone district, quarries adjoin the canal for upwards of twenty miles, having quantities of quarry spawls in spoil banks which probably can be secured for little or nothing, as they are now in the way of quarry operations and should provide a sufficient and cheap source of supply, which, while not as hard or durable as the harder grades of limestone, should prove a satisfactory foundation stone. Stone of this character was used for the foundation of Little Ridge road No. 6, which has had two years of traffic over it with little or no attention and is still in good condition.

WIDE TIRES.

Narrow tires continue to injure our roads. Monroe county has a Wide Tire Law which is operative on roads improved by State aid, but its enforcement can hardly be called rigorous, and other counties hesitate to take up the question.

MAINTENANCE.

The writer has spent much time in endeavoring to have completed roads properly maintained, with results most discouraging. The maintenance seems to be a matter of education and results are just beginning to appear. Through the cooperation of the County Engineer of Erie county an appropriation for maintenance has been made by the board of supervisors and while too late to accomplish much this year gives hopes of better results in the future. The Highway Commissioners of the towns of Brighton and Irondequoit, Monroe county, have done all in their power to maintain the improved roads in their territory, but have been unable to accomplish much owing to lack of funds and the failure of the board of supervisors to make an appropriation, notwithstanding several communications which I have transmitted to them requesting action.

There is much confusion as to the provisions of the various laws as to how the funds for maintenance are to be provided and expended, the attorneys of different boards of supervisors interpreting the laws differently. Could an amendment be made clearly and concisely covering the entire question in one act instead of through several acts as at present it would materially aid in the solution of this vexatious problem.

An effort was made to try the experiment of sprinkling with crude oil, made possible through the offer of a resident of the town of Brighton to meet the expense of the experiment, but after considerable effort it was found impossible to procure the oil at a figure low enough so as to make it possible to continue the use of oil, even in the event of success in the experiments, for which reason the matter was dropped.

A steel track system for roads has been called to my attention, but while it may have merit in localities where the cost of stone is prohibitive, it does not appeal to me as suitable for use in this section. The use of brick tracks used in a similar manner I believe has the same objections.

ORCHARD PARK ROAD, SECTION 1, NO. 27, ERIE COUNTY, N. Y.

Chapter 115, Laws of 1898.

Length of road 1.155 miles; width of metalling, 16 feet.

Chambers & Casey, contractors.

Plans approved by board of supervisors	Sept.	4, 1900
Contract dated	Sept.	27, 1900
Contract to be completed	Oct.	15, 1900
Work begun	Oct.	6, 1900
Work finished	Aug.	13, 1901
Engineer's estimate for work		$15,324 36
Contract price		12,948 00

This road runs northerly from the cross-roads in the village of Orchard Park to a point about 1,000 feet northerly of Websters Corners, an old "plank road" having a very large traffic in dairy and other farm products. The soil is of a clayey nature. A trolley track runs through the center of the southerly 1,100 feet of the improvement and along the side of the remainder of the road. Buffalo and LeRoy limestone was used for the foundation course of four inches and trap rock for the two-inch wearing course.

Considerable trouble was encountered due to springs in the village of Orchard Park and the tile underdrains laid years ago, clogged up and long since forgotten, which were displaced by the rolling of the subgrade and discovered by digging to find the cause of saturation of subgrade.

SOUTHPORT ROAD, SECTION 2, No. 28, CHEMUNG COUNTY, N. Y.

Chapter 115, Laws of 1898.

Length, 3.408 miles; width of metalling, 16 feet.

Swan & Murray, contractors.

Plans approved by board of supervisors	Oct.	2, 1900
Contract dated	July	17, 1901
Contract to be completed	Oct.	15, 1901
Work begun	July	22, 1901
Engineer's estimate of cost (revised)		$34,131 68
Contract price		33,108 00
Estimate of work to Sept. 30, 1901		12,581 04

This road is a continuation southerly of Southport road, section I, constructed last year, and passes through the village of Pine City and Seelye Creek, extending to the State line. A very bad plank road is replaced by this improvement, the old road having had no renewals of plank in several years. Local stone taken from a quarry opened by the contractors adjacent to the work and near Seelye creek is used for the foundation course and trap rock for the top. Limestone screenings are provided for in the specifications. Owing to delays in securing limestone screenings from LeRoy, with the consequent delay in construction, it was deemed that the best interest of the public would be conserved by the earlier completion of the road through use of local-stone screenings in the foundation course, and a supplemental agreement was entered into with the contractors permitting such substitution, a rebate being made upon the contract price equivalent to the difference in cost.

This work has been carried on with energy, and aside from the lack of limestone screenings is now making satisfactory progress.

SOUTHPORT ROAD, SECTION 3, NO. 29, CHEMUNG COUNTY, N. Y.

Chapter 115, Laws of 1898.

Length of road, 1.06 miles; width of metalling, 16 feet.

Costello & Neagle, contractors.

Plans approved by board of supervisors	Oct.	2, 1900
Contract dated	July	17, 1901
Contract to be completed	Oct.	15, 1901
Work begun	Aug.	24, 1901
Engineer's estimate of cost (revised)		$10,450 00
Contract price		10,634 00
Estimate of work Sept. 30, 1901		744 38

This road joins the city of Elmira with Southport road, section I, constructed a year ago, and with section II, now building, will complete the improvement of this much travelled highway from Elmira to the Pennsylvania line, and it is expected to attract much trade to Elmira from across the State line. The soil is gravelly, and although the gravel in this section is useless as a surface it forms a splendid foundation.

Local stone is used for the foundation course from the Grover quarry about a mile south of the road. Trap rock top is specified, the whole bound with limestone screenings. The same contractors are building the adjoining South Broadway road, and the reason more work has not been done on this road at this time is due to the necessity of finishing one road at a time and thus give the public an outlet.

SOUTH BROADWAY ROAD NO. 30, CHEMUNG COUNTY, N. Y.

Chapter 115, Laws of 1898.

Length of road, 1.021 miles; width of metalling, 16 feet.

Costello & Neagle, contractors.

Plans approved by board of supervisors	Oct.	2, 1900
Contract dated	July	17, 1901
Contract to be completed	Oct.	15, 1901
Work begun	July	18, 1901

Engineer's estimate of cost (revised)	$8,859 31
Contract price	9,167 00
Estimate of work Sept. 30, 1901	8,708 65

This road extends from the Elmira city line to Southport road, which it joins at Bulkhead, giving access to the improved Southport road from the westerly portion of Elmira. The soil is gravelly, making a good foundation. A local stone foundation course has been laid, with trap top bound with LeRoy limestone screenings. This road is completed with the exception of a little touching up and the 30 days of sprinkling and maintenance required by the contract.

PITTSFORD ROAD NO. 61, MONROE COUNTY, N. Y.

Chapter 115, Laws of 1898.

Length of road, 1.304 miles; width of metalling, 16 feet.

Whitmore, Rauber & Vicinus, contractors.

Plans approved by board of supervisors	Jan.	15, 1901
Contract dated	July	15, 1901
Contract to be completed	Oct.	15, 1901
Work begun	July	22, 1901
Engineer's estimate of work (revised)		$13,302 54
Contract price		13,200 00
Estimate of work to Sept. 30, 1901		11,484 00

This work is a continuation of the East Avenue road improved two years ago, and extends to the corporate lines of the village of Pittsford. The soil is a very light and shifting sand. The former grade was a series of ups and downs which in dry weather when the sand is loose, made it a very difficult road to haul over. The grades have been bettered by the cutting down of the hills and filling of the hollows. Limestone from LeRoy and from the [illegible] quarries at Rochester was used for the foundation course. Trap rock top bound with limestone screenings have been used. It is a pleasing con-

mentary upon the beneficence of road improvement that the contractors hauled stone quite five miles from their quarries at a seeming benefit, two yards or about 4,800 pounds to the load over improved roads, notwithstanding the canal was within less than a half mile of the end of their contract. Before the improvement of East avenue a ton was all a team could haul and then slowly and laboriously.

The unprecedented rainfall (largely during nights) has proven a great benefit to this road in consolidating the fills, and yet has caused little or no delay to construction. This work has been carried on in an expeditious and satisfactory manner and the contract will be completed within the contract time.

FAIRPORT ROAD NO. 60, MONROE COUNTY, N. Y.

Chapter 115, Laws of 1898.

Length of road, 3.039 miles; width of metalling, 16 feet.

Chambers & Casey, contractors.

Plans approved by board of supervisors	Jan. 15, 1901
Contract dated	July 15, 1901
Contract to be completed	Oct. 15, 1901
Work begun	July 28, 1901
Engineer's estimate of cost (revised)	$32,539 87
Contract price	32,400 00
Estimate of work Sept. 30, 1901	16,848 00

This road extends from the easterly end of the East avenue improvement to Basket street, a short distance from the corporate line of Fairport. The reason for omitting the short section before reaching Fairport is that the approaches to the bridge over the Erie canal are now very difficult, and a proposition is on foot to locate a lift bridge at this point and thus reduce the grades on the approaches. The soil is of a very light sand, shifted by every breeze and making extremely hard drawing, especially in dry weather. The improvement remedies the former difficult grades. LeRoy limestone has been used for the

foundation course, but recent difficulty at the quarry shutting off the supply from this source without warning has seriously embarrassed the contractors and delayed the work.

A small amount of Medina sandstone was used pending arrangement made for limestone from Waterloo, and in order to keep the work progressing when short of other stone, trap rock has been used in the foundation. The top is of trap rock, the whole bound with limestone screenings. This work has been prosecuted with energy and probably would have been completed except for the delay in the stone above referred to, but at this writing it hardly seems possible to complete the work this fall.

Upon the suggestion of this office the town of Perinton has contracted for and is now building a concrete bridge of 40 feet span, replacing a weak iron bridge across Irondequoit creek, upon plans and under the direction of this office, adding to the efficiency of the road.

SURVEYS.

A party making road surveys has been in the field continuously all summer taking up the various petitions in the order best suited to the demands and economy. The notes have been plotted in the office as rapidly as the available force permitted of and the plans will be completed during the coming winter as rapidly as possible.

The following tables will show in a concise way the condition of the highway improvement work up to September 30, 1901.

ROAD IMPROVEMENT TO SEPTEMBER 30, 1901.

Petition number.	Road number.	LOCATION.	State of progress.	Surveyed miles.
		Chemung County.		
52	18	Southport road, section 1	Construction finished	3.600
52	28	Southport road, section 2	Under construction	3.408
52	29	Southport road, section 3	Under construction	1.060
53	30	South Broadway road	Under construction	1.021
225	......	Wellsburg	Survey completed	4.328
		Erie County.		
202	......	Aurora-Buffalo	Plans completed	5.578
4	......	Base Line, Grand Island, section 1	Survey made	1.809
4	......	Base Line, Grand Island, section 2	Survey made	2.588
4	......	Base Line, Grand Island, section 3	Survey made	1.948
5	86	Big Tree road	Plans completed	4.004
6	69	Main street, Buffalo, section 1	Plans completed	3.415
6	87	Main street, Buffalo, section 2	Plans completed	1.926
6	......	Main street, Buffalo, section 3	Plans completed	5.625
6	......	Main street, Buffalo, section 4	Plans completed	6.581
112	27	Orchard Park road, section 1	Construction finished	1 155
112	66	Orchard Park road, section 2	Plans completed	0.952
112	67	Orchard Park road, section 3	Plans completed	3.410
112	68	Orchard Park road, section 4	Plans completed	1.170
59	23	River road, section 1	Construction finished	1.458
224	......	River road, sections 2 and 3	Plans completed	3.015
128	88	Transit road, section 1	Plans completed	4.283
128	89	Transit road, section 2	Plans completed	4.062
1	2 & 2a	Whites' Corners	Construction finished	6.540
		Livingston County.		
122	......	Dansville-Mt. Morris, section 1	Plans completed	5.373
122	......	Dansville-Mt. Morris, section 2	Plans fifty per cent completed	4.899
122	......	Dansville-Mt. Morris, section 3	Survey made	3.068
123	.....	Mt. Morris-Geneseo	Survey made	5.197
124	......	Geneseo-Avon, section 1	Plans completed	3.728
124	......	Geneseo-Avon, section 2	Plans completed	3.257
125	......	Avon-Caledonia	Plans completed	5.804
		Monroe County.		
34	82	Buffalo road, section 1	Plans completed	0.364
34	83	Buffalo road, section 2	Plans completed	5.089
38	78	Clifton road, section 1	Plans completed	3.623
196	......	Chili, section 1	Survey made	3.107
211	......	Chili, section 2	Survey made	2.556
44	......	Despatch, section 1	Plans completed	0.994
44	......	Despatch, section 2	Plans completed	0.757
37	......	Dugway road, section 1	Survey made	3.800
37	......	Dugway road, section 2	Survey made	4.019
37	.....	Dugway road, section 3	Survey made	2.880
33	5	East avenue, Rochester	Construction finished	2.450
43	60	Fairport road	About 75% constructed	3.039
39	80	Hamlin, section 1	Plans completed	4.637
39	81	Hamlin road, section 2	Plans completed	4.057
162a	......	Hilton road	Survey made	4.300
41	15	Hudson avenue, Rochester, section 1	Construction finished	0.637
178	......	Hudson avenue, Rochester, section 2	Survey made	0 995
171	......	Lake road	Survey made	2.000
40	6	Little Ridge, section 1	Construction finished	6.530
162	.....	Little Ridge, section 2	Survey made	2 062
215	.....	Little Ridge, section 3	Survey made	3.608
214	.....	Little Ridge, section 4	Survey made	3.360
195	..	Lyell avenue, Rochester	Construction finished	2.121
32	94	Monroe avenue, Rochester	Plans completed	4.226
35	......	Penfield section 1	Plans 75% completed	3.636
35	......	Penfield, section 2	Plans 75% completed	5.312
129	61	Pittsford	Construction practically finished	1.304
158	.....	Portland avenue, Rochester, section 1	Survey made	0.703
216	......	Rich's Dugway	Survey made	2.455
46	63	Scottsville, section 1	Plans completed	2.254
46	79	Scottsville, section 2	Plans completed	7.537
42	98	Webster, section 1	Plans completed	1.576
42	99	Webster, section 2	Plans completed	2.960
42	100	Webster, section 3	Plans completed	3.398
42	101	Webster, section 4	Plans completed	2.879
45	62	West Henrietta	Plans completed	6.287

Petitions Have Been Made for the Following Roads Which Have Not Been Deemed of Sufficient Importance, After a Suitable Inspection, for Improvement.

Petition number.	LOCATION.	County.	Approximate miles.
226	North Chemung	Chemung	6.0
3	Abbot	Erie	7.5
192	Allen's Creek	Monroe	2.5
163	Barnard's Crossing	Monroe	3.0
179	Clinton avenue	Monroe	0.25
197	East Henrietta	Monroe	5.00
36	Float Bridge	Monroe	8.50
212	Five Mile Line	Monroe	5.00
177	Portland avenue, section 2	Monroe	0.50
176	Ridge	Monroe	3.00
210	Redman	Monroe	....
90	Geneva-Canandaigua	Ontario	5.50
227	Bristol Valley	Ontario	....
228	Main	Ontario	4.50
62	Seth Ransome	Orleans	2.25

Recapitulation of Work Done to September 30, 1901.

COUNTY.	Miles under contract during year ending September 30, 1901.	Miles of plans and estimates completed prior to September 30, 1900.	Miles of plans and estimates completed prior to September 30, 1901.	Miles of plans and estimates completed during year ending September 30, 1901.	Miles of surveys made during year ending September 30, 1901.	Miles of contracts completed prior to September 30, 1900.	Miles of contracts completed prior to September 30, 1901.	Miles of contracts completed during year ending September 30, 1901.
Chemung	8.089	8.089	8.089	....	....	....	2.600	2.600
Erie	2.613	15.215	53.169	37.954	42.881	6.540	9.153	2.613
Livingston	....	....	18.162	18.162	31.326	....	....	....
Monroe	6.793	9.617	64.548	54.931	71.295	7.167	9.617	2.450
Total	16.495	32.921	143.968	111.047	145.502	13.707	21.370	7.663

All plans and estimates of cost completed and submitted to the various boards of supervisors have been approved and provision made for the counties shown of the expense except Main street roads, section 3 and 4, Erie county, plans for which were submitted June 4th last, and Dispatch road, section 2, Monroe county, plans for which were submitted May 29th. Inquiry has failed to find any fault with the plans or reason for lack of action by the boards of supervisors.

The writer derived pleasure and profit by attendance at the good roads meeting of supervisors held in Albany, February 14th and 15th, 1901, and the International Good Roads Congress held in Buffalo September 16th to 21st, 1901, inclusive.

The continuing requests for copies of annual reports and good roads bulletins evinces an increasing interest in the subject of highway improvement.

Cordial relations continue between this office and the representatives of the Department of Public Works on this division, and I have to acknowledge my indebtedness for many courtesies extended.

I have been ably assisted by M. W. Wilbur, resident engineer, and by all of the employees under my direction, each of whom has been ready to carry out any task assigned.

Respectfully submitted,

A. J. ROCKWOOD,

Division Engineer.

WESTERN DIVISION ERIE CANAL.

Table of Contracts Terminated During the Year Ending September 30, 1901.

CONTRACTORS.	Contract signed.	Date of final estimate.	Character of work.	Legislative Act. Chap.	Legislative Act. Laws.	Appropriation.	Engineer's estimate.	Contract price.	Final estimate.
Rudolph & Gatty	Sept. 4, 1900	Jan. 9, 1901	Culvert, Third avenue and Ironton street, North Tonawanda	420	1900	$3,500 00	$2,000 00	$1,964 80	$1,757 86
John Horan	July 26, 1900	Jan. 9, 1901	Bridge, Oak Orchard feeder, Medina	606 560 417 420	1898 1899 1900 1900	7,820 39	6,484 55	6,000 51	5,598 83
American Bridge Co	Aug. 13, 1900	April 9, 1901	....	311	1900	....	2,914 78	2,616 60	2,798 78
American Bridge Co	Aug. 13, 1900	April 9, 1901	....	311	1900	....	2,914 78	2,616 60	2,785 78
American Bridge Co	Aug. 13, 1900	April 9, 1901	....	311	1900	....	2,987 95	2,660 70	2,812 48
American Bridge Co	Aug. 13, 1900	April 9, 1901	... 160	311	1900	....	2,779 13	2,489 20	2,696 87
Frank J. Le Valley	July 26, 1900	Aug. 16, 1901	....	572	1899	10,500 00	8,174 20	8,563 91	8,562 79
Edward J. Hingston	Oct. 18, 1900	Feb. 14, 1901	Chemung canal and Glen creek, Watkins	447	1900	5,000 00	2,785 75	3,490 00	4,193 06
Baker & Judson	Nov. 23, 1900	May 15, 1901	Waste-weir and spillway, Albion	208 311	1899 1900	....	7,878 00	6,758 50	7,026 40
W. E. Flannigan	Dec. 4, 1900	May 21, 1901	Waste-weir and spillway, Spencerport	301	1900	6,000 00	2,018 00	1,310 40	1,398 22
Pulford & Clark	Oct. 11, 1900	June 11, 1901	Chemung river dyke, Elmira	221	1900	10,000 00	7,813 00	7,872 00	7,697 47
Berlin Iron Bridge Co	Oct. 26, 1900	Aug. 19, 1901	Clear creek bridge, Cattaraugus Indian Res.	569 419	1898 1900	6,600 00	4,778 00	5,036 00	4,892 83
I. M. Luddington	Oct. 17, 1900	July 15, 1901	Eighteen Mile creek improvement	609 151	1898 1900	18,000 00	12,836 80	15,645 30	11,619 85
King Bridge Co	Feb. 23, 1901	Sept. 23, 1901	Bridge No. 144 at Middleport	311	1900	....	3,127 50	2,798 00	2,714 40
King Bridge Co	Feb. 23, 1901	Sept. 23, 1901	Bridge No. 133 near Tonawanda	311	1900	....	1,860 00	1,769 00	1,764 38
			Highway Improvements.						
Chambers & Casey	Aug. 9, 1900	Dec. 1, 1900	Whites Corners road No. 2A, Erie county			....	25,570 68	23,433 00	23,433 00
Gillette & Gillette	March 6, 1899	Nov. 8, 1900	East avenue road No. 5, Monroe county	115	1898	....	11,000 00	10,500 00	11,003 40
German Rock Asphalt and Cement Co	July 26, 1900	Dec. 1, 1900	River road No. 23, Erie county	509 419	1899 1900	....	15,146 72	16,448 00	16,448 00
Edward Roche	May 16, 1900	Dec. 5, 1900	Southport road No. 13, Chemung county	643	1901	....	18,716 79	18,496 13	18,496 13
Chambers & Casey	Sept. 27, 1900	Aug. 13, 1901	Orchard Park road, sec. 1, No. 27, Erie county			....	15,324 36	13,945 00	13,039 96

WESTERN DIVISION ERIE CANAL.

Table of Contracts Pending September 30, 1901.

CONTRACTORS.	Contract signed.	Character of work.	Legislative Act. Chap.	Legislative Act. Laws.	Appropriation.	Engineer's estimate.	Contract price.	Estimated to date.
Havana Bridge Works	April 24, 1900	Chapel street bridge, Lockport	573 16	1899 1900	$24,000 00	$14,909 60	$16,915 00	$18,360 00
Niagara Construction Co.	Nov. 27, 1900	Pine and Lock street bridge, Lockport	430	1900	75,000 00	64,743 00	51,769 80	34,065 00
Works	Oct. 19, 1900	West ave	549	1899	75,000 00	67,294 00	69,528 70	34,991 00
Co.	July 20, 1901	Lyell ave	645	1901	3,000 00	2,701 00	2,437 50	....
	Oct. 19, 1900	Corning d	441	1900	4,300 00	3,279 60	3,198 79	2,522 00
		Highway Improvements.						
Chambers & Casey	July 15, 1901	Fairport road, No. 60, Monroe county	115	1898	....	32,539 97	32,400 00	16,848 00
Whitmore, Rauber & Vicinus	July 16, 1901	Pittsford road, No. 61,	569	1899	....	13,302 54	18,200 00	11,484 00
Swan & Murray	July 17, 1901	Southport road, section county	419	1900	....	36,516 55	32,108 00	12,581 94
Costello & Neagle	July 17, 1901	Southport road, section county	642	1901	....	10,447 81	10,634 00	744 38

Summary of Engineering Expenses upon the Western Division New York State Canals for the Fiscal Year Ending September 30, 1901.

	Authorized by— Chapter.	Authorized by— Laws.	Amount.
Extraordinary Repairs of Canals.			
Fish creek culvert	208	1899	$25 00
Brockville waste-weir	208	1899	25 00
South St. Paul street wall	208	1899	41 28
Albion waste-weir	208 311	1899 1900	1,303 65
State yard, Lockport	208	1899	78 32
Bridges Nos. 144 and 183	311	1900	394 28
Vertical walls section 9	311	1900	56 05
Repairing abutment, bridge No. 128	311	1900	140 60
Culvert No. 50, Spencerport	311	1900	69 16
Vertical wall, bridge No. 135	311	1900	41 75
Repairing culvert No. 38, Brighton	311	1900	38 35
Waste-weir, Brockport, N. Y	311	1900	12 78
Vertical wall, bridge No. 133	311	1900	3 18
Vertical walls, Lockport	311	1900	22 54
Rebuilding vertical walls, bridge No. 116	311	1900	33 05
Rebuilding slope walls wide-waters west of Rochester	311	1900	109 01
Vertical wall, Albion, N Y	311	1900	219 73
Bridges Nos 132, 147, 154 and 160	311	1900	307 34
Rebuilding vertical walls, Genesee Valley feeder	311	1900	87 41
Repairing and improving locks 53 to 66	311	1900	141 96
Rebuilding vertical walls, Lowertown, Lockport	311	1900	186 62
Rebuilding abutment, bridge No. 124	311	1900	122 63
Raising slope walls from 1600 feet west of bridge 59 to lock 63	311	1900	107 95
Vertical wall, bridge No. 147	311	1900	7 14
Vertical wall, bridge No. 115	311	1900	3 65
Canal Improvements.			
Spencerport waste-weir	201	1900	336 79
Mud creek improvement	572	1899	380 06
Chemung canal, Watkins	447	1900	299 21
Culvert Third avenue and Ironton street, North Tonawanda	423	1900	265 78
Beemans, Gotts and Ransoms creeks improvement	443	1900	138 98
Eighteen Mile creek improvement	609 151	1899 1900	676 85
Ohio street bridge, Clark & Skinner Canal	695	1901	108 44
West avenue bridge	549	1899	2,423 61
Medina bridge, Oak Orchard feeder	569 426	1899 1900	127 81
Chapel street bridge	573 16	1899 1900	1,322 35
Pine and Lock streets bridge	430	1900	3,933 64
Plymouth avenue bridge	732	1901	94 00
Lyell avenue footbridge	645	1901	82 05
Ferry street bridge	618	1899	117 56
Vertical wall, Eagle Harbor	686	1901	37 96
Survey for Court of Claims	419	1900	3,655 12
Barge Canal survey	411	1900	1,081 28
General Fund.			
Corning dyke, Steuben county	441	1900	342 00
Chemung river dyke	231	1900	1,191 48
Conewango creek improvement	448	1900	503 15
Glen creek improvement	699	1901	111 80
Cattaraugus creek bridge, Versailles, N. Y	645	1901	115 28
Clear creek bridge, Cattaraugus Indian Reservation	569 419	1899 1900	557 88
Highway improvements	115 569 419 298 642	1898 1899 1900 1900 1901	20,496 45
Ordinary repairs	570 418	1899 1900	7,100 82
Total	....	....	$49,001 78

IMPROVEMENTS PUBLIC HIGHWAYS.

(Chapter 115, Laws 1898; Chapter 569, Laws 1899; Chapter 419, Laws 1900; Chapter 642 Laws 1901.)

East Avenue, West Henrietta, Despatch, Hamlin, Clifton, Penfield, Buffalo, Pittsford, Webster, Fairport. Monroe Avenue, Scottsville, Dugway, Hudson Avenue, Little Ridge, Lyell, Rich's Dugway, Hilton, Lake, Portland Avenue, Chili, Monroe County; *White's Corners No. 2 and No. 2A, Transit, Orchard Park, Big Tree, Main Street, Base Line, River, Aurora and Buffalo,* Erie County; *Southport, South Broadway, Wellsburg,* Chemung County; *Bench Marks, Geneseo–Avon, Dansville–Mt. Morris, Avon–Caledonia, Mt. Morris–Geneseo,* Livingston County.

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer	....	$250 per mo.	$989 93	$234 78	$1,224 71
M. W. Wilbur	Resident engineer	....	200 per mo.	249 75	105 03	354 78
T. J. Morrison	Assistant engineer	238	5 00 per day	1,190 00	1 15	1,191 15
Garrett O. House	Assistant engineer	84	5 00 per day	420 00	77 12	497 12
T. W. Barrally	Assistant engineer	134½	5 00 per day	672 50	30 05	702 55
H. D. Alexander	Assistant engineer	161	5 00 per day	805 00	18 77	823 77
D. D. Waldo	Assistant engineer	17½	5 00 per day	87 50	9 90	97 40
J. B Barrett	Leveler	87	4 50 per day	391 50	33 04	424 54
E, V. R. Payne	Leveler	11	4 50 per day	49 50	5 14	54 64
Isaac O. Cole	Leveler	311½	4 50 per day	1,401 75	168 31	1,570 06
H. J. Hemstreet	Leveler	249	4 50 per day	1,120 50	35	1,120 85
Geo. D. Williams	Leveler	216½	4 50 per day	974 25	78 76	1,053 01
John K. Lloyd	Draughtsman	101	4 50 per day	454 50	....	454 50
H. G. McKelvey	Draughtsman	164	4 00 per day	636 00	....	656 00
R. T. Webster	Rodman	7½	3 50 per day	26 25	....	26 25
Tracy B. Smith	Rodman	80½	3 50 per day	281 75	23 44	305 19
Sherman D. Enoch	Rodman	64	3 50 per day	224 00	13 37	237 37
Joseph W. Howe	Rodman	312	3 50 per day	1,092 00	189 38	1,281 38
Thos. L. Wilson	Rodman	160	3 50 per day	560 00	72 38	632 38
C. J. Bean	Rodman	222½	3 50 per day	778 75	50 02	828 77
Walter Dubey	Rodman	64	3 50 per day	224 00	19 32	243 32
H. S. Ball	Rodman	68	3 50 per day	238 00	25 73	263 73
F. W. Hamilton	Rodman	95	3 50 per day	332 50	29 52	362 02
D. S. Hollenbeck	Boatman	25	3 00 per day	75 00	2 75	77 75
F. V. Searls	Chainman	12	3 00 per day	36 00	50	36 50
F. W. Gerstner	Chainman	259	2 50 per day	647 50	78 85	726 35
A. W. Gillis	Chainman	112	2 50 per day	280 00	9 77	289 77
Lawrence Kavanagh	Chainman	202½	2 50 per day	506 25	54 05	560 30
Chas. F. Swain	Chainman	121	2 50 per day	302 50	32 36	334 86
E. J. Greiner	Chainman	64	2 50 per day	160 00	19 12	179 12
A. B. Williams	Laborer	80	2 00 per day	160 00	24 80	184 80
John Patterson	Laborer	124	2 00 per day	248 00	74 94	322 94
Harry D. Waldo	Laborer	66	2 00 per day	132 00	16 84	148 84
Fred. A. Weller	Laborer	27	2 00 per day	54 00	....	54 00
Clinton J. Turner	Laborer	122	2 00 per day	244 00	85 76	329 76
William Tiffany	Laborer	122	2 00 per day	244 00	84 55	328 55
E. P. Strowger	Laborer	182	2 00 per day	364 00	122 98	486 98
Edward S. Atwood	Laborer	36½	2 00 per day	73 00	13 51	86 51
John B. Sweeney	Laborer	245½	2 00 per day	491 00	1 45	492 45

Incidental Expenses.		$19,044 92
Livery	$1,012 75	
Telegraph and telephone	56 99	
Postage	7 06	
Miscellaneous	376 78	
		1,453 53
Total		$20,498 45

Plymouth Avenue Bridge.

(Chapter 732, Laws 1901.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer	...	$250 per mo.	$8 34	$0 10	$8 44
H. D. Alexander	Assistant engineer	10½	5 00 per day	52 50	82	53 32
H. J. Hemstreet	Leveler	1	4 50 per day	4 50	....	4 50
A. W. Gillis	Chainman	6	2 50 per day	15 00	....	15 00
F. W. Gerstner	Chainman	1	2 50 per day	2 50	....	2 50
A. B. Williams	Laborer	2	2 00 per day	4 00	20	4 20
John B. Sweeney	Laborer	3	2 00 per day	6 00	....	6 00
						$93 96
Incidental Expenses.						
Miscellaneous						04
Total						$94 00

Lyell Avenue Foot Bridge.

(Chapter 645, Laws 1901.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
J. B. Barrett	Leveler	2	$4 50 per day	$9 00	$0 45	$9 45
H. J. Hemstreet	Leveler	3½	4 50 per day	15 75	....	15 75
Philip H. Dater	Draftsman	7	5 00 per day	35 00	55	35 55
Thad. L. Wilson	Rodman	1	3 50 per day	3 50	35	3 85
F. V. Searls	Chainman	5	3 00 per day	15 00	10	15 10
John B. Sweeney	Laborer	1	2 00 per day	2 00	35	2 35
Total						$82 05

Pine and Lock Street Bridge.

(Chapter 420, Laws 1900.)

		$3,771 36
Incidental Expenses.		
Livery	$6 00	
Postage	6 43	
Fuel and light	6 67	
Printing	78 40	
Telegraph and telephone	14 14	
Miscellaneous	50 64	
		162 28
Total		$3,933 64

Medina Bridge, Oak Orchard Feeder.

(Chapter 569, Laws 1899; chapter 426, Laws 1900).

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Lockwood	Division engineer	....	$250 per mo.	$4 17	$1 32	$5 49
M. W. Wilbur	Resident engineer	....	200 per mo.	13 32	4 48	17 80
F. J. Morrison	Assistant engineer	½	5 00 per day	2 50	....	2 50
R. F. Webster	Rodman	4	3 50 per day	14 00	....	14 00
F. V. Searle	Chainman	21	3 00 per day	63 00	7 30	70 30
						$110 09
Incidental Expenses.						
Postage					$0 53	
Telegraph and telephone					30	
Miscellaneous					50	
Stowall and Cunningham, for inspection					16 40	
						17 73
Total						$127 81

Chapel Street Bridge.

(Chapter 578, Laws 1899; Chapter 16, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer	....	$250 per mo.	$58 38	$16 01	$74 39
M. W. Wilbur	Resident engineer	....	200 per mo.	13 32	7 09	20 41
Garrett O. House	Assistant engineer	48½	5 00 per day	242 50	3 90	246 40
E. V. R. Payne	Leveler	47	4 50 per day	211 50	1 00	212 50
P. H. Dater	Draughtsman	2	5 00 per day	10 00	1 12	11 12
Walter Dubey	Rodman	159	3 50 per day	556 50	1 00	557 50
R. F. Webster	Rodman	3	3 50 per day	10 50	....	10 50
F. V. Searls	Chainman	2	3 00 per day	6 00	3 99	9 99
A. W. Gillis	Chainman	2	2 50 per day	5 00	....	5 00
John Patterson	Laborer	2	2 00 per day	4 00	....	4 00
Edward S. Atwood	Laborer	3	2 00 per day	6 00	1 32	7 32
						$1,159 13

Incidental Expenses.

Livery	$4 00	
Postage	1 57	
Telegraph and telephone	8 69	
Miscellaneous	10 98	
Fuel and light	7 75	
Stowell & Cunningham, for inspection	130 23	
		163 22
Total		$1,322 35

Ohio Street Bridge, Clark and Skinner Canal.

(Chapter 695, Laws 1901.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer	....	$250 per mo.	$4 17	$2 83	$7 00
T. J. Morrison	Assistant engineer	2	5 00 per day	10 00	....	10 00
F. W. Barrally	Assistant engineer	5	5 00 per day	25 00	11 00	36 00
H. J. Hemstreet	Leveler	2½	4 50 per day	11 25	....	11 25
E. V. R. Payne	Leveler	1	4 50 per day	4 50	1 10	5 60
C. J. Bean	Rodman	3	3 50 per day	10 50	1 57	12 07
Lawrence Kavanagh	Chainman	4	2 50 per day	10 00	10 92	20 92
						$102 84

Incidental Expenses.

Telegraph and telephone	$0 35	
Miscellaneous	25	
		60
Total		$103 44

West Avenue Bridge.

(Chapter 549, Laws 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer	....	$250 per mo.	$270 20	$25 33	$295 53
M. W. Wilbur	Resident engineer	....	200 per mo.	46 62	85	47 47
Isaac O. Cole	Leveler	1	4 50 per day	4 50	10	4 60
Philip H. Dater	Draughtsman	187	5 00 per day	935 00	2 35	937 35
R. T. Webster	Rodman	26	3 50 per day	91 00	....	91 00
F. V. Searls	Chainman	229	3 00 per day	687 00	1 17	688 17
F. W. Gerstner	Chainman	2½	2 50 per day	6 25	....	6 25
A. W. Gillis	Chainman	123	2 50 per day	307 50	....	307 50
A. B. Williams	Laborer	15	2 00 per day	30 00	....	30 00
						$2,407 87

Incidental Expenses.

Telegraph and telephone	$3 50	
Miscellaneous	12 24	
		15 74
Total		$2,423 61

Ordinary Repairs.

(Chapter 570, Laws 1899, and Chapter 418, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer	....	$250 per mo.	$575 28	$110 86	$686 14
M. W. Wilbur	Resident engineer	....	200 per mo.	861 04	33 61	894 65
T. J. Morrison	Assistant engineer	20	$5 00 per day	100 00	10 17	110 17
Garrett O. House	Assistant engineer	½	5 00 per day	2 50	....	2 50
H. D. Alexander	Assistant engineer	9½	5 00 per day	47 50	7 00	54 50
C. G. Harger, Jr	Financial clerk	313	5 00 per day	1,565 00	....	1,565 00
H. J. Hemstreet	Leveler	12	4 50 per day	54 00	....	54 00
J. B. Barrett	Leveler	8	4 50 per day	36 00	16 75	52 75
E. V. R. Payne	Leveler	1	4 50 per day	4 50	40	4 90
Isaac O. Cole	Leveler	1	4 50 per day	4 50	10	4 60
Philip H. Dater	Draughtsman	11½	5 00 per day	57 50	2 90	60 40
John K. Lloyd	Draughtsman	5	4 50 per day	22 50	....	22 50
H. G. McKelvey	Draughtsman	17	4 00 per day	68 00	....	68 00
Thad L. Wilson	Rodman	6	3 50 per day	21 00	10 72	31 72
Tracy B. Smith	Rodman	7½	3 50 per day	26 25	7 49	33 74
Joseph W. Howe	Rodman	1	3 50 per day	3 50	10	3 60
R. T. Webster	Rodman	1	3 50 per day	3 50	70	4 20
F. V. Searls	Chainman	4½	3 00 per day	13 50	5 71	19 21
Anna M. Lorscheider	Stenograher	311	2 25 per day	699 75	....	699 75
Edward S. Atwood	Laborer	9	2 00 per day	18 00	....	18 00
John B. Sweeney	Laborer	9	2 00 per day	18 00	40	18 40
John Patterson	Laborer	2	2 00 per day	4 00	1 25	5 25
A. B Williams	Laborer	8½	2 00 per day	17 00	....	17 00
E. P. Strocoger	Laborer	1	2 00 per day	2 00	10	2 10
						$4,433 08

Incidental Expenses.

Stationery and printing	$674 58	
Postage	121 50	
Livery	21 50	
Office rent	600 00	
Telegraph and telephone	566 44	
Miscellaneous	683 72	
		2,667 74
Total		$7,100 82

Ferry Street Bridge.

(Chapter 618, Laws 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary	Travel.	Total.
A. J. Rockwood	Division engineer.	....	$250 per mo.	$20 85	$11 11	$31 96
Garrett O. House	Assistant engineer	4	5 00 per day	20 00	1 10	21 10
T. J. Morrison	Assistant engineer	4	5 00 per day	20 00	....	20 00
H. J. Hemstreet	Leveler	½	4 50 per day	2 25	....	2 25
Sherman D Enoch	Rodman	3	3 50 per day	10 50	60	11 10
E. J. Greiner	Chainman	3	2 50 per day	7 50	1 20	8 70
Charles T. Swain	Chainman	3	2 50 per day	7 50	85	7 85
Harry D. Waldo	Laborer	3	2 00 per day	6 00	80	6 80
						$109 76
Incidental Expenses.						
Telegraph and telephone					$6 79	
Miscellaneous					1 01	
						7 80
Total						$117 56

Vertical Wall, Eagle Harbor.

(Chapter 686, Laws 1901.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
M. W. Wilbur	Resident engineer	....	$200 per mo.	$6 66	$2 10	$8 76
Philip H. Dater	Draughtsman	3½	5 00 per day	17 50	1 50	19 00
H. G. McKelvey	Draughtsman	½	4 00 per day	2 00	....	2 00
F. V. Searls	Chainman	1	3 00 per day	3 00	1 60	4 60
John B. Sweeney	Laborer	1	2 00 per day	2 00	1 55	3 55
						$37 91
Incidental Expenses.						
Miscellaneous						05
Total						$37 96

Survey for Court of Claims.

(Chapter 419, Laws of 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer	....	$250 per mo.	$258 14	$123 61	$381 75
M. W. Wilbur	Resident engineer	....	200 per mo.	619 15	88 28	707 43
T. J. Morrison	Assistant engineer	1	5 00 per day	5 00	....	5 00
T. W. Barrally	Assistant engineer	8½	5 00 per day	42 50	....	42 50
Garrett O House	Assistant engineer	2½	5 00 per day	12 50	6 30	18 80
D. D. Waldo	Assistant engineer	3½	5 00 per day	17 50	6 27	23 77
J. B. Barrett	Leveler	26	4 50 per day	117 00	9 79	126 79
H. J. Hemstreet	Leveler	½	4 50 per day	2 25	....	2 25
Philip H Dater	Draughtsman	103	5 00 per day	515 00	79 08	594 08
John K. Lloyd	Draughtsman	109½	4 50 per day	492 75	....	492 75
Tracy B. Smith	Rodman	16	3 50 per day	56 00	2 30	58 30
R. T. Webster	Rodman	165	3 50 per day	577 50	7 35	584 85
Sherman D. Enoch	Rodman	3	3 50 per day	10 50	....	10 50
Frank V. Searls	Chainman	10	3 00 per day	30 00	3 89	33 89
A. W. Gillis	Chainman	67	2 50 per day	167 50	42 33	209 83
Lawrence Kavanagh	Chainman	6	2 50 per day	15 00	....	15 00
Chas. F. Swain	Chainman	3	2 50 per day	7 50	....	7 50
F. W. Gerstner	Chainman	3½	2 50 per day	8 75	....	8 75
E. J. Greiner	Chainman	3	2 50 per day	7 50	....	7 50
John B. Sweeney	Laborer	2	2 00 per day	4 00	....	4 00
John Patterson	Laborer	63	2 00 per day	126 00	31 44	157 44
E. V. Allendorph	Laborer	18	2 00 per day	36 00	10 53	46 53
Edward S. Atwood	Laborer	½	2 00 per day	1 00	25	1 25
A. B. Williams	Laborer	14	2 00 per day	28 00	95	28 95
						$3,569 41

Incidental Expenses.

Livery	$24 00	
Telegraph and telephone	13 29	
Miscellaneous	48 42	
		85 71
Total		$3,655 12

Canal Survey.

(Chapter 411, Laws of 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer	....	$250 per mo.	$85 00	$52 70	$137 70
M. W. Wilbur	Resident engineer	....	200 per mo.	83 98	....	83 98
H. D. Alexander	Assistant engineer	4	5 00 per day	20 00	2 00	22 00
T. W. Barrally	Assistant engineer	8	5 00 per day	40 00	20 04	60 04
Garrett O. House	Assistant engineer	5	5 00 per day	25 00	17 86	42 86
T. J. Morrison	Assistant engineer	6	5 00 per day	30 00	....	30 00
George D. Williams	Leveler	2	4 50 per day	9 00	4 69	13 69
H. J. Hemstreet	Leveler	7	4 50 per pay	31 50	....	31 50
John K. Lloyd	Draughtsman	6	4 50 per day	27 00	....	27 00
H. G. McKelvey	Draughtsman	6	4 00 per day	24 00	....	24 00
M. W. Tuttle	Rodman	6	3 50 per day	21 00	....	21 00
Thad L. Wilson	Rodman	2	3 50 per day	7 00	4 69	11 69
C. J. Bean	Rodman	2	3 50 per day	7 00	4 44	11 44
F. W. Hamilton	Rodman	7	3 50 per day	24 50	15 57	40 07
R. T. Webster	Rodman	6	3 50 per day	21 00	....	21 00
George Anderson	Foreman boring	6	3 25 per day	19 50	3 00	22 50
W. E. Dohrman	Foreman boring	2	3 25 per day	6 50	1 00	7 50
Martin Wagner	Foreman boring	2	3 25 per day	6 50	1 00	7 50
James M. Wilson	Chainman	2	2 50 per day	5 00	....	5 00
F. F. Bean	Chainman	6	2 50 per day	15 00	....	15 00
Frank Jackson	Chainman	6	2 50 per day	15 00	....	15 00
H. C. Titus	Chainman	6	2 50 per day	15 00	....	15 00
Lawrence Kavanaugh	Chainman	8	2 50 per day	20 00	4 69	24 69
F. W. Gerstner	Chainman	2	2 50 per day	5 00	4 44	9 44
F. V. Searls	Chainman	2	3 00 per day	6 00	....	6 00
John B. Sweeney	Laborer	10	2 00 per day	20 00	3 00	23 00
A. B. Williams	Laborer	33	2 00 per day	66 00	26 00	92 00
J. H. Sinclair	Laborer	6	2 00 per day	12 00	3 00	15 00
R. W. Shannon	Laborer	6	3 00 per day	12 00	3 00	15 00
Edward Zorsch	Laborer	6	2 00 per day	12 00	3 00	15 00
Matthew Meiser	Laborer	2	2 00 per day	4 00	1 00	5 00
A. J. LaBaie	Laborer	6	2 00 per day	12 00	3 00	15 00
Roy A. Taylor	Laborer	2	2 00 per day	4 00	1 00	5 00
James Dear	Laborer	2	2 00 per day	4 00	1 00	5 00
Charles Schuth	Laborer	6	2 00 per day	12 00	3 00	15 00
George Kelley	Laborer	6	2 00 per day	12 00	3 00	15 00
Alfred Briggs	Laborer	2	2 00 per day	4 00	....	4 00
John Foley	Laborer	1	2 00 per day	2 00	50	2 50
George Moreland	Laborer	1	2 00 per day	2 00	50	2 50
Frank Quinn	Laborer	1	2 00 per day	2 00	50	2 50
H. J. Taylor	Laborer	2	2 00 per day	4 00	1 00	5 00
J. B. Storms	Laborer	2	2 00 per day	4 00	1 00	5 00
H. S. Carpenter	Laborer	6	2 00 per day	12 00	3 00	15 00
Smith Tucker	Laborer	6	2 00 per day	12 00	3 00	15 00
F. F. Johnson	Laborer	2	2 00 per day	4 00	1 00	5 00
						$982 10
Incidental Expenses.						
Livery					$52 00	
Office rent					16 67	
Telegraph and telephone					3 73	
Postage					28	
Miscellaneous					26 50	
						99 18
Total						$1,081 28

Chemung Canal, Watkins.

(Chapter 447, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer	....	$250 per mo.	$20 85	$7 66	$28 51
M. W. Wilbur	Resident engineer	....	200 per mo.	9 99	8 30	18 29
T. W. Barrally	Assistant engineer	17½	5 00 per day	87 50	17 24	104 74
C. J. Bean	Rodman	14	3 50 per day	49 00	4 10	53 10
Lawrence Kavanagh	Chainman	5½	2 50 per day	13 75	5 10	18 85
						$223 49
Incidental Expenses.						
Livery					$1 00	
Telegraph and telephone					4 87	
Miscellaneous					85	
						6 72
Total						$230 21

Third Avenue and Ironton Street Culvert, North Tonawanda.

(Chapter 423, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer	....	$250 per mo.	$16 68	$5 88	$22 56
M. W. Wilbur	Resident engineer	....	200 per mo.	9 99	2 92	12 91
T. J. Morrison	Assistant engineer	½	5 00 per day	2 50	....	2 50
Tracy B. Smith	Rodman	55	3 50 per day	192 50	10 56	203 06
						$241 03
Incidental Expenses.						
Postage					$0 30	
Telegraph and telephone					3 47	
Miscellaneous					20 98	
						24 75
Total						$265 78

Beemans, Ransom and Gotts Creeks Improvement.

(Chapter 442, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
J. B. Barrett	Leveler	20	$4 50 per day	$90 00	$4 63	$94 63
R. T. Webster	Rodman	12	3 50 per day	42 00	....	42 00
John B. Sweeney	Laborer	1	2 00 per day	2 00	....	2 00
						$138 63
Incidental Expenses.						
Postage						35
Total						$138 98

Eighteen Mile Creek Improvement.

(Chapter 609, Laws 1899, and Chapter 151, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer	....	$250 per mo.	$16 68	$9 58	$26 26
M. W. Wilbur	Resident engineer	....	200 per mo.	33 30	8 11	41 41
H. D Alexander	Assistant engineer	½	5 00 per day	2 50	....	2 50
T. J. Morrison	Assistant engineer	2	5 00 per day	10 00	....	10 00
E. V. R. Payne	Leveler	49½	4 50 per day	222 50	16 34	238 84
George D. Williams	Leveler	20	4 50 per day	90 00	....	90 00
R. T. Webster	Rodman	1	3 50 per day	3 50	....	3 50
Tracy B. Smith	Rodman	1	3 50 per day	3 50	....	3 50
Walter Dubey	Rodman	4	3 50 per day	14 00	1 00	15 00
F. V. Searls	Chainman	6½	3 00 per day	19 50	9 24	28 74
A. B. Williams	Laborer	3	2 00 per day	6 00	7 34	13 34
Edward S. Atwood	Laborer	40	2 00 per day	80 00	11 80	91 80
						$564 89
Incidental Expenses.						
Livery					$84 50	
Telegraph and telephone					2 11	
Postage					30	
Miscellaneous					25 05	
						111 96
Total						$676 85

Spencerport Waste-Weir.

(Chapter 201, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer	....	$250 per mo.	$43 36	$2 47	$45 83
M. W. Wilbur	Resident engineer	....	200 per mo.	26 64	2 65	29 29
T. J. Morrison	Assistant engineer	2½	5 00 per day	12 50	....	12 50
H. J. Hempstreet	Leveler	2½	4 50 per day	11 25	....	11 25
Tracy B. Smith	Rodman	48	3 50 per day	168 00	10 67	178 67
R. T. Webster	Rodman	½	3 50 per day	1 75	....	1 75
F. W. Gerstner	Chainman	2½	2 50 per day	6 25	2 33	8 58
						$287 87
Incidental Expenses.						
Printing					$46 02	
Telephone					36	
Miscellaneous					1 28	
Postage					1 26	
						48 92
Total						$336 79

Mud Creek Improvement.

(Chapter 572, Laws 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer	....	$250 per mo.	$4 17	$4 64	$8 81
Thad. L. Wilson	Rodman	65	3 50 per day	227 50	....	227 50
F. W. Gerstner	Chainman	48	2 50 per day	120 00	1 25	121 25
John B. Sweeney	Laborer	1	2 00 per day	2 00	....	2 00
						$359 56
Incidental Expenses.						
Livery					$6 50	
Postage					50	
Telephone					15	
Miscellaneous					13 35	
						20 50
Total						$380 06

General Fund—Conewango Creek Improvement.

(Chapter 448, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer	....	$250 per mo.	$25 02	$13 63	$38 65
H. D. Alexander	Assistant engineer	13	5 00 per day	65 00	....	65 00
John G. Peck	Bridge designer	....	166 67 per mo.	75 00	....	75 00
Isaac O. Cole	Leveler	1	4 50 per day	4 50	....	4 50
H. J. Hemstreet	Leveler	1	4 50 per day	4 50	....	4 50
H. G McKelvey	Draughtsman	½	4 00 per day	2 00	....	2 00
Thad. L. Wilson	Rodman	29	3 50 per day	101 50	43 75	145 25
Sherman D. Enoch	Rodman	10	3 50 per day	35 00	12 95	47 95
Chas. F. Swain	Chainman	10	2 50 per day	25 00	14 28	39 28
E. J. Greiner	Chainman	10	2 50 per day	25 00	11 47	36 47
F. W. Gerstner	Chainman	1½	2 50 per day	3 75	....	3 75
Anna M. Lorscheider	Stenographer	2	2 25 per day	4 50	....	4 50
Harry D. Waldo	Laborer	6	2 00 per day	12 00	10 51	22 51
						$489 36

Incidental Expenses.

Livery	$9 75	
Telegraph and telephone	2 72	
Miscellaneous	1 32	
		13 79
Total		$503 15

General Fund—Glen Creek Improvement.

(Chapter 699, Laws 1901.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer	....	$250 per mo.	$16 68	$0 60	$17 28
T. W. Barrally	Assistant engineer	2	5 00 per day	10 00	3 60	13 60
Geo. D. Williams	Leveler	2	4 50 per day	9 00	3 60	12 60
H. J. Hemstreet	Leveler	8	4 50 per day	36 00	....	36 00
J. V. Searls	Chainman	1	3 00 per day	6 00	6 10	12 10
Lawrence Kavanaugh	Chainman	2	2 50 per day	5 00	4 25	9 25
John B. Sweeney	Laborer	2	2 00 per day	4 00	6 00	10 00
						$110 83

Incidental Expenses.

Telegraph	$0 55	
Miscellaneous	42	
		97
Total		$111 80

General Fund—Cattaraugus Creek Bridge, Versailles, N. Y.

(Chapter 685, Laws 1901.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood..........	Division engineer....	....	$250 per mo.	$33 36	$12 20	$45 56
M. W. Wilbur.	Resident engineer...	....	200 per mo.	3 33	1 49	4 82
T J. Morrison	Assistant engineer..	4	5 00 per day	20 00	....	20 00
H. J. Hemstreet..........	Leveler	5½	4 50 per day	24 75	....	24 75
Tracy B. Smith	Rodman	2	3 50 per day	7 00	5 36	12 36
						$107 49
Incidental Expenses.						
Livery					$6 50	
Telegraph and telephone........................					1 09	
Miscellaneous..................................					20	
						7 79
Total..						$115 28

General Fund—Clear Creek Bridge, Cattaraugus Indian Reservation.

(Chapter 569, Laws 1899, chapter 419, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood..........	Division engineer....	....	$250 per mo.	$17 51	$19 76	$37 27
M. W. Wilbur	Resident engineer...	....	200 per mo.	29 97	26 51	56 48
Tracy B. Smith...........	Rodman	108	3 50 per day	378 00	36 86	414 86
F. W. Gerstner	Chainman	1	2 50 per day	2 50	5 93	8 43
						$517 04
Incidental Expenses.						
Livery					$13 50	
Postage					2 39	
Telegraph and telephone........................					3 05	
Miscellaneous..................................					21 90	
						40 84
Total..						$557 88

General Fund—Corning Dyke, Steuben County.

(Chapter 441, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel	Total.
A. J. Rockwood	Division engineer	....	$250 per mo,	$4 17	$6 83	$11 00
M. W. Wilbur	Resident engineer	....	200 per mo.	3 33	4 48	7 81
T. W. Barrally	Assistant engineer	36½	5 00 per day	182 50	27 72	210 22
C. J. Bean	Rodman	19½	3 50 per day	68 25	16 38	84 63
R. T. Webster	Rodman	1½	3 50 per day	1 75	....	1 75
Lawrence Kavanaugh	Chainman	6	2 50 per day	15 00	6 30	21 30

Incidental Expenses.

		$336 71
Postage	$0 91	
Telegraph and telephone	3 58	
Miscellaneous	80	
		5 29
Total		$342 00

General Fund—Chemung River Dyke.

(Chapter 231, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel	Total.
A. J. Rockwood	Division engineer	....	$250 per mo	$66 72	$42 38	$109 10
M. W. Wilbur	Resident engineer	...	200 per mo.	39 96	22 98	62 94
T. W. Barrally	Assistant engineer	114½	5 00 per day	572 50	30 21	602 71
C. J. Bean	Rodman	62	3 50 per day	217 00	2 35	219 35
Lawrence Kavanaugh	Chainman	68½	2 50 per day	171 25	5 95	177 20

Incidental Expenses.

		$1,171 30
Livery	$1 50	
Postage	2 09	
Telegraph and telephone	9 09	
Miscellaneous	7 50	
		20 18
Total		$1,191 48

Extraordinary Repairs—Fish Creek Culvert.

(Chapter 208, Laws 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel	Total.
T. J Morrison	Assistant engineer	5	$5 00 per day	$25 00	....	$25 00

Extraordinary Repairs—Brockville Waste-Weir.

(Chapter 208, Laws 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
T. J. Morrison	Assistant engineer	5	$5 00 per day	$25 00	....	$25 00

Extraordinary Repairs—South St. Paul Street Wall.

(Chapter 208, Laws 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
M. W. Wilbur	Resident engineer	...	$200 per mo	$19 98	$0 05	$20 03
F. J. Morrison	Assistant engineer	2	5 00 per day	10 00	....	10 00
H. J. Hemstreet	Leveler	2½	4 50 per day	11 25	....	11 25
Total	....	....	....	....	....	$41 28

Extraordinary Repairs—Albion Waste-Weir.

(Chapter 208, Laws 1899; chapter 311, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer	....	$250 per mo.	$172 63	$28 90	$201 53
M. W. Wilbur	Resident engineer	....	200 per mo	139 86	22 23	162 09
T. J. Morrison	Assistant engineer	2	5 00 per day	10 00	....	10 00
H. J. Hemstreet	Leveler	½	4 50 per day	2 25	....	2 25
J. B. Barrett	Leveler	1	4 50 per day	4 50	1 05	5 55
John K. Lloyd	Draughtsman	5½	4 50 per day	24 75	....	24 75
F. W. Hamilton	Rodman	98	3 50 per day	343 00	13 73	356 73
H. S. Ball	Rodman	106	3 50 per day	371 00	2 22	373 22
R. F. Webster	Rodman	½	3 50 per day	1 75	....	1 75
F. V. Searles	Chainman	5	3 00 per day	15 00	5 74	20 74
F. W. Gerstner	Chainman	1	2 50 per day	2 50	1 99	4 49
John Patterson	Chainman	1	2 00 per day	2 00	1 99	3 99
						$1,167 09

Incidental Expenses.

Postage	$2 20	
Livery	7 00	
Telegraph and telephone	3 17	
Printing	84 46	
Miscellaneous	39 73	
		136 56
Total		$1,303 65

Extraordinary Repairs—Bridges Nos. 144 and 153.

Chapter [illegible], Laws 1900.

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer		$250 per mo.	$[illegible]	$[illegible]	$[illegible]
M. W. Wilbur	Resident engineer		200 per mo.	[illegible]	4 [illegible]	[illegible]
Garrett O. [illegible]	Assistant engineer	[illegible]	3 [illegible] per day	75 [illegible]	[illegible]	[illegible]
T. J. Morrison	Assistant engineer	4	3 [illegible] per day	[illegible]		[illegible]
E. T. R. Payne	Leveler	4	4 50 per day	[illegible]	2 [illegible]	[illegible]
E. Y. Webster	Rodman	25	3 50 per day	[illegible]	[illegible]	[illegible]
						$[illegible]
Incidental Expenses.						
Livery					$[illegible]	
Postage					[illegible]	
Printing					[illegible]	
Telegraph and telephone					[illegible]	
Miscellaneous					2 [illegible]	
						[illegible]
Total						$[illegible]

Extraordinary Repairs—Vertical Walls, Section IX.

Chapter 3[illegible], Laws 19[illegible].

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
J. B. Barrett	Leveler	6	$4 50 per day	$27 00	$8 52	$[illegible]
A. B. Williams	Laborer	7	2 00 per day	14 00	6 [illegible]	[illegible]
						$53 53
Incidental Expenses.						
Telegraph					30	
Miscellaneous					20	
						50
Total						$54 [illegible]

Extraordinary Repairs—State Yard, Lockport.

(Chapter 2[illegible], Laws 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer		$250 per mo.	$33 36		$33 36
M. W. Wilbur	Resident engineer		300 per mo.	39 96		39 96
Total						$73 32

Extraordinary Repairs—Repairing Culvert No. 38, Brighton.

(Chapter 311, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
J. B. Barrett	Leveler	2½	$4 50 per day	$11 25	$0 45	$11 70
R. F. Webster	Rodman	5	3 50 per day	17 50	10	17 60
A. B. Williams	Laborer	4	2 00 per day	8 00	1 05	9 05
Total						$38 35

Extraordinary Repairs—Waste-Weir, Brockport, N. Y.

(Chapter 311, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
J. B Barrett	Leveler	2	$4 50 per day	$9 00	$2 53	$11 53
A. B. Williams	Laborer	½	2 00 per day	1 00		1 00
						$12 53
Incidental Expenses.						
Telegraph						25
Total						$12 78

Extraordinary Repairs—Vertical Wall, Bridge No. 133.

(Chapter 311, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
J. B. Barrett	Leveler	½	$4 50 per day	$2 25	$0 93	$3 18

Extraordinary Repairs—Vertical Walls, Lockport, N. Y.

(Chapter 311, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel	Total.
J. B. Barrett	Leveler	1⅓	$4 50 per day	$9 00	$1 54	$10 54
A. B. Williams	Laborer	6	2 00 per day	12 00		12 00
Total						$22 54

Extraordinary Repairs—Rebuilding Vertical Walls at Bridge 147.

(Chapter 311, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
J. B. Barrett	Leveler	1	$4 50 per day	$4 50	$2 64	$7 14

Extraordinary Repairs—Vertical Walls at Bridge No. 115.

(Chapter 311, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
J. B. Barrett	Leveler	½	$4 50 per day	$2 25	$1 40	$3 65

Extraordinary Repairs—Repairing Abutment, Bridge No. 128.

(Chapter 311, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
J. B. Barrett	Leveler	18	$4 50 per day	$81 00	$19 98	$100 98
R. T. Webster	Rodman	3	3 50 per day	10 50	....	10 50
A. B. Williams	Laborer	10½	2 00 per day	21 00	7 35	28 35
						$139 83
Incidental Expenses.						
Miscellaneous						0 77
Total						$140 60

Extraordinary Repairs—Culvert No. 50, *Spencerport.*

(Chapter 311, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
J. B. Barrett	Leveler	8½	$4 50 per day	$38 25	$6 24	$44 49
R. T. Webster	Rodman	2	3 50 per day	7 00	....	7 00
A. B. Williams	Laborer	6½	2 00 per day	13 00	2 18	15 18
						$66 67
Incidental Expenses.						
Telegraph					$0 60	
Miscellaneous					1 89	
						2 49
Total						$69 16

Extraordinary Repairs—Vertical Walls, Bridge No. 135.

(Chapter 311, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
J. B. Barrett	Leveler	7	$4 50 per day	$31 50	$2 25	$33 75
A. B. Williams	Laborer	4	2 00 per day	8 00	....	8 00
Total						$41 75

Extraordinary Repairs—Rebuilding Vertical Walls, Bridge No. 116.

(Chapter 311, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
J. B. Barrett	Leveler	3½	$4 50 per day	$15 75	$5 94	$21 69
A. B. Williams	Laborer	3½	2 00 per day	7 00	4 26	11 26
						$32 95
Incidental Expenses.						
Miscellaneous						10
Total						$33 05

Extraordinary Repairs—Rebuilding Slope Walls at Wide Waters, West of Rochester.

(Chapter 311, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
J. B. Barrett	Leveler	12	$4 50 per day	$54 00	$4 25	$58 25
R. T. Webster	Rodman	4	3 50 per day	14 00	....	14 00
A. B. Williams	Laborer	14½	2 00 per day	29 00	3 80	32 80
John B. Sweeney	Laborer	1½	2 00 per day	3 00	20	3 20
						$108 25
Incidental Expenses.						
Telegraph					$0 40	
Miscellaneous					36	
						76
Total						$109 01

Extraordinary Repairs—Vertical Wall, Albion, N. Y.

(Chapter 311, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Lockwood	Division engineer	....	$250 per mo.	$8 34	....	$8 34
J. A. Barrett	Leveler	23½	4 50 per day	105 75	$37 15	142 90
A. B Williams	Laborer	23½	2 00 per day	47 00	18 64	65 64
						$216 88
Incidental Expenses.						
Telegraph					$1 60	
Miscellaneous					1 25	
						2 85
Total						$219 73

Extraordinary Repairs—Bridges Nos. 132, 147, 154 *and* 160.

(Chapter 311, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer	....	$250 per mo.	$16 68	....	$16 68
M. W. Wilbur	Resident engineer	....	200 per mo.	46 62	$7 72	54 34
Garrett O. House	Assistant engineer	6	5 00 per day	30 00	5 06	35 06
J. B. Barrett	Leveler	1	4 50 per day	4 50	......	4 50
H. J. Hemstreet	Leveler	4	4 50 per day	18 00	6 72	24 72
H. G. McKelvey	Draughtsman	½	4 00 per day	2 00	....	2 00
R. T. Webster	Rodman	1	3 50 per day	3 50	....	3 50
Edward S. Atwood	Laborer	2	2 00 per day	4 00	7 12	11 12
						$151 92
Incidental Expenses.						
Livery					$20 00	
Telegraph					25	
Printing					56 63	
Stowell & Cunningham, inspectors					78 54	
						155 42
Total						$307 34

Extraordinary Repairs—Rebuilding Vertical Walls Genesee Valley Feeder.

(Chapter 311, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary	Travel.	Total.
J. B. Barrett	Leveler	8	$4 50 per day	$36 00	$1 65	$37 65
R. T. Webster	Rodman	4	3 50 per day	14 00	....	14 00
John B Sweeney	Laborer	1	2 00 per day	2 00	10	2 10
A. B. Williams	Laborer	14½	2 00 per day	29 00	3 95	32 95
						$86 70
Incidental Expenses.						
Telegraph					$0 51	
Miscellaneous					20	
						71
Total						$87 41

Extraordinary Repairs—Repairing and Improving Locks 53 to 66.

(Chapter 311, Laws 1900.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
J. B. Barrett	Leveler	16	$4 50 per day	$72 00	$9 51	$81 51
R. T. Webster	Rodman	4	3 50 per day	14 00	....	14 00
A. B. Williams	Laborer	23	2 00 per day	46 00	45	46 45
Total						$141 96

Extraordinary Repairs — Rebuilding Vertical Walls, Lower Town, Lockport, N. Y.

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
J. B. Barrett	Leveler	21	$4 50 per day	$94 50	$53 49	$147 99
R. T. Webster	Rodman	1	3 50 per day	3 50	....	3 50
A. B. Williams	Laborer	11½	2 00 per day	23 00	10 28	33 28
						$184 77
Incidental Expenses.						
Telegraph					$0 50	
Miscellaneous					1 35	
						1 85
Total						$186 62

Extraordinary Repairs—Rebuilding Abutment, Bridge No. 124.

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
J. B Barrett	Leveler	17½	$4 50 per day	$78 75	$15 80	$94 55
A. B. Williams	Laborer	12½	2 00 per day	25 00	2 63	27 63
						$122 18
Incidental Expenses.						
Telegraph						45
Total						$122 63

Extraordinary Repairs — Raising Slope Walls from 1,000 *Feet West of Bridge No.* 59 *to Lock No.* 63.

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total
J. B. Barrett	Leveler	9½	$4 50 per day	$42 75	$5 95	$48 70
R. T. Webster	Rodman	3	3 50 per day	10 50	....	10 50
A. B. Williams	Laborer	21	2 00 per day	42 00	5 85	47 85
						$107 05
Incidental Expenses.						
Telegraph					$0 35	
Miscellaneous					55	
						90
Total						$107 95

REPORT ON GAUGINGS

OF THE

Volume of Discharge of Streams

IN THE STATE OF NEW YORK,

1901.

Under direction of EDWARD A. BOND, State Engineer and Surveyor of New York, in Co-operation with United States Geological Survey, F. H. NEWELL, Chief of Division of Hydrography.

Report on Gaugings of New York Streams, 1901.

By Robert E. Horton.

METHODS EMPLOYED IN GAUGING NEW YORK STREAMS.

The following report contains the results of hydrographic work done in the State of New York, pursuant to the provisions of chapter 64, Laws of 1901, in cooperation with the United States Geological Survey. The results of investigations carried out under the provisions of a similar law in 1900 are also included. In republishing the data presented in the report for 1900 many corrections of the text have been made, and a great deal of additional matter given.

At the time the work was undertaken in April, 1900, gauging records were being kept at about twenty stations, most of which had been established in connection with the upper Hudson Storage Survey of 1895 and 1896, or by the U. S. Board of Engineers on Deep Waterways,([a]) 1897-1899.

These stations were all in connection with dams and mills. The method pursued in gauging the discharge of a stream at a dam may be briefly outlined as follows: Considering first the dam proper, the length and profile of the crest has in each case been determined during the season of low water, and the volume of flow, corresponding to a series of observed depths on the crest, has been computed by the weir formula.

In order to take into account modifications of discharge, due to variations in the width of crest of dams, slope and form of aprons, etc., values of the coefficient C have been selected in

(a) See Reports of State Engineer and Surveyor of New York, 1895 and 1896, and Report of U. S. Board of Engineers on Deep Waterways, 1897-1899, pt. 11.

each case, as deduced from expriments made at the hydraulic laboratory of Cornell University, for the United States Board of Engineers on Deep Waterways, and also by John R. Freeman, C. E., have largely been drawn upon.

In many cases the profiles of the dams are slightly irregular. The dam is divided into sections which are computed separately, all points in a given section being nearly or precisely at the same elevation. For rough calculations of flood flows, etc., the average crest elevation is sometimes taken. This method gives slightly too small results throughout, inasmuch as the discharge over the lower part of the crest is greater in proportion to the head than that over the higher portions of the profile.

Gauges have, as a rule, been placed several feet upstream from dams, where the cross-sectional areas of the mill ponds are so great as to make the velocity of approach negligible.

Having calculated the flow for a series of crest depths, extending from zero to the extreme high water mark, a discharge curve has been plotted, from which the volume of flow over the entire dam, corresponding to any gauge height, could be read directly. When flashboards are placed on dams, the conditions are reduced more nearly to those of a standard sharp edged weir, and Francis' well-known formula has been used in computing the discharge. The flow over waste weirs, auxiliary spillways and flood overflows has been calculated in a manner similar to that used for dams. The amount of flow through head gates, sluiceways, feeder gates and similar openings has been calculated from the formula for orifices. Precise experiments to determine the value of the coefficient of discharge through large submerged orifices, as in bulkheads or canal feeder gates, are greatly needed.

In estimating the discharge through turbine water wheels the results of tests, made at the testing flume of the Holyoke Water Power Company, have been largely depended upon, the mean discharge for each day having been computed from the observed working head, width of opening of speed gates and number of hours each wheel has run. A record of these facts is kept at

each of the stations where there are mills in connection with dams.

One difficulty encountered in gauging northern streams results from the accumulation of ice during the winter season. It has been found impossible to keep some dams clear of ice, and an effort is made to keep a record of the length of the clear and unobstructed portion of the dam from which a correction in the calculated flow can be made.([a])

Views of the cross-sections of many of the dams where gauging records are kept, as well as the results of the experiments made at Cornell University to determine the proper coefficients of discharge, may be found in a paper on Flow of Water Over Dams, by George W. Rafter, M. Am. Soc. C. E., contained in Trans. Am. Soc. C. E., Vol. XLIV, pages 220-398. See also Water Supply and Irrigation Paper, U. S. Geol. Survey, No. 35, page 2. In connection with all older stations at dams and mills, an effort has been made to check and improve upon the previous results by making current meter measurements to determine the volume of flow through turbine water wheels and the proper allowance to be made for leakage of dams, and to check the calculated flow over dams.

In the establishment of stations no single method of gauging has been adopted to the exclusion of all others. The report shows results obtained at dams and mills, by measurements over standard weirs, through thin partitions, by current meter, and by the slope formula. In many instances two or more methods have been combined at a single station. Owing to different methods and conditions, the degree of accuracy obtained is not uniform throughout the records. An effort has been made to describe each station with sufficient fullness to enable the reader to clearly understand the methods employed and probable accuracy of the results.

Recent developments in electric transmission have given an impetus to the construction of substantial masonry dams

(a) See Paper, Difficulties encountered in Gauging Streams over Dams, H. A. Pressey, 21st An. Report U. S. Geol. Survey, pt. 4, pp. 21-30.

and power plants on many streams, affording almost ideal conditions for maintaining gauging records. Most of the stations at dams are in connection with such plants. Private individuals or corporations interested often cooperate, and excellent records are in this way obtained with comparatively slight expense. At the newer stations, where the current-meter method is employed, a modified form of Price meter, adopted by the U. S. Geological Survey, has been used. This instrument is made in two sizes, the larger for strong currents, the smaller for streams of moderate or low velocity of flow.

The usual mode of procedure is to submerge the current-meter 0.6 of the depth of the stream at measured intervals across the channel and record the revolutions for a period of 100 seconds. In cases of doubt, surface and bottom velocities are also taken, or the flow determined by the method of integration as a check. The mean velocity in vertical planes is also measured from time to time to check the accuracy of the "0.6" method, and also to determine whether any progressive change is taking place in the measuring section, due to sedimentation or scour.

The current meters used are calibrated each year at the rating station of the Geological Survey at Chevy Chase, Md. A rating table for the meter is then prepared, by means of which the velocity of flow of the stream can be deduced from the observed revolutions per second of the meter wheel. Soundings are taken in connection with the meter observations, and a simple multiplication of the velocity in each section by the cross-sectional area to which it applies gives the rate of discharge. A river height gauge is established at each current-meter station from which the stage of the stream is observed once or twice daily. Current-meter measurements of the discharge are made from time to time as opportunity permits. When a sufficient number of discharge measurements have been made, they are plotted, using the gauge heights of the stream as ordinates and the measured discharges as abscissas. A mean curve is drawn through the plotted points showing the

Fig. No. 1.—Price Current-meter: Modified large size, 1901.

discharge as a function of the gauge reading. By means of this curve the average discharge-rate for each day is deduced from the record of the height of the stream kept by the gauge reader.

The principal sources of error in gauging streams by the current-meter method are due to the effect of slack or nearly slack water in any part of the cross-section, or to backwater from dams, from obstructing ice, or from tributaries entering below the gauging station, thereby causing the river stage to rise at times without a proportional increase in the discharge. In accordance with the well-known Kutter formula, the volume of flow in an open channel is a function of the slope, area of cross-section and wetted perimeter. When a stream is rising, the slope is usually greater at a given stage of the stream than at the same stage when falling. Northern streams, as a rule, rise rapidly and fall gradually, so that the stream is falling on the majority of days of the year. The error from the above source is small, inasmuch as the discharge varies only as the square root of the slope. The principal difficulty encountered results from freezing over of streams in winter. The ice serves greatly to increase the wetted perimeter of the measuring section, thereby modifying the rating curve. Whenever practicable, discharge measurements during winter months are made through the ice. The accuracy of individual current-meter measurements depends chiefly upon the number of velocity observations taken in the cross-section.

Owing to rapid fall, with frequent rifts, backwater from dams, obstruction by ice, and other characteristics of New York streams, the difficulty of maintaining continuous gauging records which will show with sufficient accuracy the discharge rate day by day throughout the year is very great. This is especially true in streams whose discharge fluctuates between wide limits.

The discharge of the lower Mohawk at Rexford Flats and Schenectady, for example, varies from 500 to 55,000 second-feet

or more. In such cases methods of gauging applicable at low and ordinary stages may not give equally reliable results during freshets; or the reverse may be true, the results being most accurate for high water.

In connection with the meter stations it is necessary to employ as gauge readers persons living near the site selected for the measuring section, and who have, as a rule, had no previous experience in similar work. Their observations are forwarded at the end of each week. As a check on the records so obtained, inspection trips are made at frequent intervals and independent gauge readings taken by the hydrographer. On receipt of the gauge reader's record for the corresponding period the two sets of observations are compared. The close agreement found in most cases testifies to the intelligent and careful work of the observers.

At the beginning of the work in 1900 many of the older stations were neglected and the painted gauge boards originally used were worn out. The stations have been equipped throughout with heavy hardwood or cypress gauges, having brass or galvanized metal figures and division marks. At a number of current-meter stations where there was no opportunity to secure vertical gauges in permanent position, weight and wire gauges are used. These are perhaps less accurate than direct reading vertical gauges; but convenience and freedom from ice obstruction are in their favor. A weight gauge is attached to the guard-rail of a bridge. A more usual method is to secure it by outriggers to the horizontal bridge chords in such a manner as to be least disturbed by traffic and to permit the removal or renewal of the bridge floor planks without disturbing the gauge.

In this connection acknowledgment is made of the services of those who have assisted in the field work and in the preparation of this report. Special credit is due to J. D. Luther and M. T. Reilly.

FORUMLAE.

The following hydraulic formulae have been employed in the calculation of gauging records. They are frequently referred to by name in the report, and are given here for reference:

The weir formula.

This name has been given to the general expression for flow over a weir or dam in its simplest form.

$$Q = C\,L\,H^{\frac{3}{2}} \quad (1)$$

This may also be written

$$Q = \tfrac{2}{3}\,K\,L\,H\,\sqrt{2\,g\,H} = M\,L\,H\,\sqrt{2\,g\,H} \quad (2)$$

$Q =$ volume of discharge in second-feet.

$$C = \tfrac{2}{3}\,K\,\sqrt{2\,g} = m\,\sqrt{2\,g} \quad (3)$$

$L =$ length of crest or clear overflow, feet corrected for end contractions if any.

$H =$ head on crest corrected for velocity of approach if any.

C, K and m are constants, determined by experiments.

The Francis formula for a sharp-edged weir.[a]

$$Q = 3.33\,L\,H^{\frac{3}{2}} \quad (4)$$

If the weir has end contractions

$$L = L' - 0.1\,n\,H \quad (5)$$

$L' =$ actual length of crest, feet.

$n =$ number of complete contractions.

If the approaching stream has an appreciable average velocity in the cross-section of the leading channel opposite the point where h is measured

$$H = \left[(h+d)^{\frac{3}{2}} - d^{\frac{3}{2}}\right]^{\frac{2}{3}} \quad (6)$$

$h =$ actual measured head on weir, feet.

$d =$ head due to mean velocity V, in the leading channel.

The Francis formula for Merrimac dam.[b]

$$Q = 3.01208\,L\,H^{1.53} \quad (7)$$

(a) Lowell Hydraulic Experiments, J. B. Francis, pp. 112–120.

(b) Lowell Hydraulic Experiments, J. B. Francis, pp. 136–137.

Mullin's formula.[a]

This is used by East Indian engineers in designing irrigation works.

$$Q = \tfrac{2}{3}\, c\, L\, H \sqrt{2\, g\, H} \quad (8)$$

For a sharp-edged weir:

$$c = 1 - \left(\frac{0.04\,(34.6+H)}{.4}\right) = 0.654 - 0.01\, H \quad (9)$$

For a broad crested weir C′ is used.

$$C' = c - \left(\frac{0.025\, c\,(B+1)}{H+1}\right) \quad (10)$$

B = width of flat crest in feet.

Bazin's formula.[b]

$$Q = M\, L\, h \sqrt{2\, g\, h} \quad (11)$$

M is a coefficient experimentally determined by Bazin for thin-edged and various other forms of weirs. This formula differs from those given above in that the coefficient M includes the correction for velocity of approach, the measured head h being applied directly in the formula.

Formula for orifices.

$$Q = C\, A \sqrt{2\, g\, H} \quad (12)$$

C is a variable coefficient, its value depending on the degree of contraction in area of the issuing jet.

A = area of orifice, square feet.

This formula is applied to submerged orifices by making H the difference in elevation of the water surface on the upstream and downstream sides.

If the water approaches the orifice with an appreciable velocity, a correction is applied to the measured head in a manner similar to that used for weirs.

(a) Mullin's Irrigation Manual, pp. 138–139.
(b) Annales des Ponts et Chaussées, October, 1888.

DESCRIPTION OF TABLES OF DAILY DISCHARGE.

The object of the stream gaugings briefly stated, is to determine for each day the volume of flow or rate of discharge of the stream measured.

For mill streams, where the water is held back as pond storage during the dry season, it is impossible to determine the natural regimen of flow of the stream. This is especially true with reference to Sundays or holidays, when mills are not running. If, at the time the water wheels are stopped, the water stands below the level of the crest line of the dam, the flow in the stream channel below will be nil, or at best, will only equal the leakage of the dam, flumes, or penstocks.

With regard to estimation of Sunday flows, no uniform rule has been followed. In case of some of the older records, the Sunday flow during the dry season has been taken as the mean of the calculated flows for the preceding and following days, and this method, where previously used, has been adhered to. In other instances the flow given in the table for each day is that shown by the gauging record, and represents, as nearly as may be, the actual amount of water flowing in the stream channel below the dam, but may be quite different from the amount entering the pond above the dam.

The relation existing between the canals of New York and the streams of the central portion of the State is very implicit. Diversion from the headwaters of a number of streams for the supply of canals virtually reduces their effective drainage areas. As a result, the summer watershed may be materially less in area and differ widely in its water yielding characteristics from the region tributary to the stream when the canals are not in operation.

It often happens that a single gauge reading, taken at or near the culmination of a flood, shows a larger flow than the mean for any single day. The result of such isolated observations, together with other data relative to extremes of flow, have been given for a number of stations. Where two or more gauge readings are taken each day, the mean of the readings

for 24-hour periods is used as an argument in entering rating tables to determine the mean daily flow. Theoretically, the several discharge rates should be separately determined for each gauge reading and the average taken. The method of averaging the gauge readings is much simpler, and it is believed that the error due to the fact that the discharge increases more rapidly than the stream stage both for dams and current meter sections, is well within the limit of error of the results in most cases. Where water fluctuates above and below the crests of dams, due to draught from pondage at mills, the discharge is usually computed for the period when water level is above crest and the equivalent rate of discharge if the flow were distributed through 24 hours, is used.

DRAINAGE TRIBUTARY TO LAKE ONTARIO.

This region includes the third river system in magnitude of the state; the Seneca, Oneida, Oswego Basin. The character of the run-off varies from the Genesee river in the west with relatively low rainfall, little forest, and great extremes of flow; to the Black river, draining a region of heavier precipitation, better ground storage and well maintained regimen at all seasons.

Most of the streams possess notable waterfalls where they pass from the areas of rock outcrop into the ancient Laurentian lake basin.

MOOSE RIVER BELOW McKEEVER, HERKIMER COUNTY, N. Y.

A gauging station was established on this stream at Moose river 4 miles below McKeever railroad station, on June 5, 1900. The section of the channel chosen to be spanned by a cableway has a width of 225 feet, with a nearly flat gravel bottom. A vertical gauge board was attached to a pile driven some distance out in the stream beyond the low water margin, and protected from ice and logs by a floating boom anchored upstream.

This stream is characterized throughout its entire course by rifts and rapids. Topographically, the watershed is rocky, pre-

cipitous and mostly timbered. The drainage area above the gauging station is 346 square miles. An area of 41 square miles in the headwaters is subject to regulation by storage, controlled by a State dam at Old Forge, at the foot of the Fulton Chain of lakes.

There are numerous undeveloped water powers on the stream, including two falls near Lyonsdale, where a head of 30 feet or more might be obtained, and Miller's Falls, below Moose river, of nearly equal height.

Water power is developed at eight dams, utilizing a total fall of 225 feet, with an aggregate capacity of the turbines installed of over 7,000 horse power.

Lumbermen's dams, at the foot of several principal lakes, hold back a portion of the waters of the spring freshet to be used for log driving.

No current meter measurements have thus far been made. Gauge readings are taken twice daily, morning and evening, by Chris. Hannon, and the mean of the two readings for each day is shown in the accompanying tables.

Daily Gauge Heigth, in feet, of Moose River at Moose River, N. Y.

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1900												
1	......	......	......	......	......	......	0.50	0.85	0.90	0.70	1.15	......
2	......	......	......	......	......	......	.60	.70	.80	.75	1.20	......
3	......	......	......	......	......	......	.25	.70	.65	.80	1.05	......
4	......	......	......	......	......	......	.85	.60	.55	.70	.95	......
5	......	......	......	......	......	2.00	.80	.50	.60	.60	.85	......
6	......	......	......	......	......	1.55	.35	.55	.55	.60	1.10	......
7	......	......	......	......	......	1.25	.70	.60	.55	.60	1.10	......
8	......	......	......	......	......	1.20	.85	.55	.60	.65	2.25	......
9	......	......	......	......	......	1.95	.75	.55	.65	.60	3.10	......
10	......	......	......	......	......	1.55	.70	.60	.70	.60	2.50	......
11	......	......	......	......	......	1.40	.65	.70	.55	.65	1.75	......
12	......	......	......	......	......	1.20	.90	.65	.55	.55	1.15	......
13	......	......	......	......	......	1.08	.90	.80	.55	.45	.95	......
14	......	......	......	......	......	1.05	.80	1.80	.50	.45	.90	......
15	......	......	......	......	......	.82	.75	1.75	.40	.70	1.25	......
16	......	......	......	......	......	1.05	.70	1.25	.70	.85	1.75	......
17	......	......	......	......	......	0.92	0.80	1.20	0.70	0.75	2.05	......
18	......	......	......	......	......	.65	.75	1.00	.65	.60	2.80	......
19	......	......	......	......	......	.60	.85	.85	.60	.65	1.70	......
20	......	......	......	......	......	.80	.90	.60	.55	.75	3.95	......
21	......	......	......	......	......	.95	.80	.60	.80	.75	4.45	......
22	......	......	......	......	......	.90	.65	.60	1.20	.70	4.10	......
23	......	......	......	......	......	.80	.55	.50	1.55	.70	3.70	......
24	......	......	......	......	......	.70	.60	.45	1.80	1.80	3.33	......
25	......	......	......	......	......	.80	.85	.55	1.05	2.00	3.20	......
26	......	......	......	......	......	.60	3.05	.65	.90	1.65	3.03	......
27	......	......	......	......	......	.40	1.85	1.75	.90	1.80	3.65	......
28	......	......	......	......	......	.30	1.20	2.00	.85	1.80	3.75	......
29	......	......	......	......	......	.50	.90	1.85	.70	1.23	3.55	......
30	......	......	......	......	......	.55	.75	1.40	.80	1.25	3.20	......
31	......	......	......	......	......	....	.70	.95	......	1.80	......	......

Daily Gauge Height, in feet, of Moose River at Moose River, N. Y.

DAY.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	....	....	....	.....	[illegible]	[illegible]	[illegible]	2.6	[illegible]	[illegible]	[illegible]	[illegible]
2	....	....	....	.....	[illegible]	1.1	[illegible]	[illegible]	1.6	[illegible]	[illegible]	[illegible]
3	....			....	[illegible]	[illegible]	[illegible]	[illegible]	2.6	[illegible]	[illegible]	[illegible]
4		....	....	....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.5	[illegible]	[illegible]
5	....	....	....	....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.6	[illegible]	[illegible]
6	....	....	....	....	2.4	1.4	[illegible]	[illegible]	[illegible]	2.1	[illegible]	[illegible]
7	....	....	....		2.6	4.4	[illegible]	[illegible]	[illegible]	2.1	[illegible]	[illegible]
8	....	....	....	.....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
9	....	....	....	....	2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	....	....	....	....	[illegible]	[illegible]	[illegible]	2.1	[illegible]	[illegible]	[illegible]	[illegible]
11	....	....	....	[illegible]	[illegible]	1.4	[illegible]	2.2	[illegible]	1.9	[illegible]	[illegible]
12	....	....	....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
13	....	....	....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	..
14	....	....	....	[illegible]	[illegible]	2.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	...
15	....	....	....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.6	2.3	.....
16	....	....	....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.....
17	....	....	....	3.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.....
18	....	....	....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.4	[illegible]	....
19	....	....	....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	....
20	....	....	....	[illegible]	[illegible]	[illegible]	[illegible]	1.6	[illegible]	[illegible]	[illegible]	4.3
21	....	....	....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.5	[illegible]	[illegible]	4.4
22	....	....	....	[illegible]	2.3	[illegible]	[illegible]	[illegible]	1.4	[illegible]	[illegible]	[illegible]
23	....	....	....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.3	[illegible]
24	....	....	....	[illegible]	[illegible]	[illegible]	[illegible]	1.4	1.4	2.2	[illegible]	[illegible]
25	....	....	....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.3	2.2	[illegible]	[illegible]
26	....	....	....	4.4	[illegible]	1.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	....	....	....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	....	....	....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.4	[illegible]
29	....	....	....	[illegible]	[illegible]	[illegible]	2.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
30	....	....	....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.9	[illegible]	1.4	[illegible]
31	....	....	....	......	[illegible]	......	[illegible]	[illegible]	......	1.2	......	[illegible]

Principal Developed Water Powers on Moose River.

No. of dam.	Mills at dam.	LOCATION.	Effective head. Feet.	H. P. of water wheels.	Number of employees.	Manufacture.
1	1	Near Lyons Falls	18	560	30	Wood pulp.
2	1	Near Lyons Falls	30	1,208	31	Wood pulp.
3	1	Near Lyons Falls	35	1,736	25	Wood pulp.
4	1	Lyonsdale	30	850	25	Wood pulp.
5	1	Lyonsdale	30	400	2	Paper.
6	1	Lyonsdale	35	1,252	40	Pulp and paper.
7	1	Above Lyonsdale	30	1,000	40	Manila paper.

BEAVER RIVER AT TISSE'S BRIDGE, LEWIS COUNTY, N. Y.

Beaver River rises in western Hamilton county, crosses Herkimer county and emerges from the Adirondacks at Number Four on the Lewis county line. The flow from the tributary watershed above Beaver, comprising an area of 153 square miles or 47.5 per cent. of the entire drainage area, is regulated by storage in the Beaver flow or "Stillwater," an artificial lake formed by a timber dam 16 feet high.

Fig. No. 2.—Beaver River: Gauge Board at Tisse Bridge, Lewis County, N Y.

Fig. No. 3.—Beaver River: Tisse Falls, Lewis County, N. Y.

In addition to the reservoir formed by the State dam at Beaver, there are in this region over fifty natural lakes, including Red Horse Chain, so that a comparatively uniform flow of the stream is maintained throughout the summer season.

From the State dam at Beaver to Number Four, a distance of 10 miles, the stream consists of numerous boulder rapids alternating with short stretches of smooth water. Above Beaver Lake occurs a fall, forming a descent of 60 feet within 400 or 500 feet. From the foot of Beaver Lake to Belfort, a distance of 12 miles, the stream channel continues rocky and precipitous, although the adjacent watershed is sandy and for the most part covered with timber. Eagle Falls, 2 miles below Beaver Lake, consists of a series of cascades aggregating a descent of 75 feet. There are a number of other undeveloped water powers in this vicinity. Water power is developed at Beaver Falls, Croghan and Belfort, aggregating 4,400 horse power at five dams, and utilizing a fall of 133 feet. There is also an abandoned power at Tisse's Falls, where a head of 16 feet could be obtained. Power is developed at Belfort under a head of 50 feet, for the generation of electricity, which is transmitted to adjacent towns, a distance of 16 miles.

An examination of Beaver River, in relation to facilities for gauging, was made in July, 1900. The almost continuous rapids in the upper reaches of the stream, coupled with the fact that all stretches of smooth water are filled with logs much of the time, make the selection of a site for a permanent gauging station very difficult. Tisse's bridge, crossing the river between the village of Croghan and Belfort, was finally chosen, and a gauging record started May 10, 1901. The bridge crosses the stream at the head of Tisse's Falls at a point where the gaugings will be unobstructed by either log booms or ice. The bridge consists of two spans of 76.5 and 51.5 feet width respectively, crossing two arms of the stream on opposite sides of a wooded rocky island, one-half acre in extent.

A 12-foot cypress gauge, divided to feet and tenths, was secured to the down stream face of the right-hand abutment

of the right span. The bench mark is a chiseled "O" in the bridge-seat above the gauge board.

Elevation of bench mark........................ 100.00
Elevation gauge zero........................ 88.70

One observation of the river stage is taken each day by the gauge reader, Nicholas Tisse.

Owing to the existence of cross currents under the bridge, current meter observations of the velocity have been taken in every square foot of the cross section of the stream and the direction of flow of the corresponding filaments, as well as their velocity is taken into consideration in calculating the discharge. The results of current meter measurements are shown below:

Daily Gauge Height of Beaver River at Tisse's Bridge, Croghan, N. Y.

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1	......	......	......	......	......	3.1	2.1	2.1	3.6	2.5	2.6	2.3
2	......	......	......	......	......	3.1	2.1	2.0	1.6	2.7	2.7	2.6
3	......	......	......	......	......	3.3	2.0	1.8	1.7	3.0	2.5	2.7
4	......	......	......	......	......	3.5	2.0	1.2	1.7	3.1	2.5	2.6
5	......	......	......	......	......	3.6	2.1	2.0	2.7	2.8	2.5	2.7
6	......	......	......	......	......	3.5	2.1	2.0	2.2	2.9	2.4	2.8
7	......	......	......	......	......	3.6	2.1	2.1	2.2	2.8	2.5	2.7
8	......	......	......	......	......	3.5	2.1	2.1	2.0	2.7	2.4	2.6
9	......	......	......	......	......	3.7	2.0	2.2	2.2	2.8	2.4	2.9
10	......	......	......	......	......	3.6	2.1	2.3	1.9	2.6	2.3	2.8
11	......	......	......	......	......	3.5	2.0	2.3	2.0	2.7	3.2	2.9
12	......	......	......	......	......	3.1	2.0	2.7	1.9	2.5	3.0	3.4
13	......	......	......	......	......	2.9	2.0	2.2	2.1	2.8	2.4	3.5
14	......	......	......	......	......	2.9	1.9	2.1	2.0	2.9	2.2	3.3
15	......	......	......	......	......	2.7	1.9	2.7	2.6	3.0	3.0	6.5
16	......	......	......	......	......	2.4	1.9	2.3	2.6	3.0	3.1	5.4
17	......	......	......	......	2.9	2.2	1.8	2.2	2.8	3.0	2.8	4.3
18	......	......	......	......	2.4	2.2	1.9	1.8	2.7	2.9	2.9	4.0
19	......	......	......	......	2.4	2.3	1.9	1.8	2.6	3.0	2.7	4.2
20	......	......	......	......	2.1	2.7	1.8	1.8	2.5	2.9	2.8	3.9
21	......	......	......	......	2.2	2.9	1.6	1.5	2.3	2.9	2.6	3.8
22	......	......	......	......	2.5	2.9	1.6	1.5	2.2	2.8	2.6	3.8
23	......	......	......	......	2.0	2.8	1.4	2.0	2.3	2.8	2.4	3.7
24	......	......	......	......	2.4	2.9	2.3	2.5	2.4	3.0	2.5	3.4
25	......	......	......	......	2.0	2.6	2.3	2.3	2.2	2.8	2.7	3.3
26	......	......	......	......	2.7	2.6	1.2	2.2	2.3	2.8	2.8	3.4
27	......	......	......	......	2.1	2.4	2.2	1.4	2.3	2.8	2.7	3.6
28	......	......	......	......	2.9	2.5	2.0	1.6	1.1	2.8	2.8	3.4
29	......	......	......	......	2.9	2.9	2.9	1.8	1.2	2.8	2.8	2.9
30	......	......	......	......	3.0	2.3	2.7	1.9	2.0	3.0	2.7	2.9
31	......	......	......	......	2.8	......	2.7	2.0	......	2.6	......	2.9

DATE.	Gauge height, feet.	Discharge, second-feet.
July 4, 1901	2.02	263
May 29, 1901	2.98	521
June 10, 1901	3.50	997

The drainage area of Beaver River above Castorland, where it empties into Black River, is 322 square miles. The drainage area above the gauging station at Tisse's Bridge is approximately 242 square miles.

Rainfall and other meteorological records have been kept since January, 1889, at Number Four, in the heart of the timber covered portion of the watershed.

BLACK RIVER AT HUNTINGTONVILLE, JEFFERSON COUNTY, N. Y.

This river rises in Herkimer county and flows in a northeasterly direction into Black River Bay, an arm of Lake Ontario. A portion of its course is shown on the Watertown atlas sheet of the United States Geological Survey. Observations of the height of water have been made at the dam of the city waterworks of Watertown, located two miles above at Huntingtonville. The station was established on February 22, 1897, and the record has been furnished by Frank A. Hinds, M. Am. Soc. C. E. ([a])

The conditions at this point are peculiar, in that the stream flows in two channels, with an island between. A high timber dam on the right branch creates a settling basin for the water supply of the city of Watertown. The other dam, on the opposite side of the island, is also of timber, and gauge readings are taken at a point about 500 feet above this dam. The crest of the dam is slightly irregular in profile, and for ease of computation has been divided into six parts, each of these being considered as horizontal. There is an elbow in the plan of the dam with its apex downstream, the juncture of the two wings being strengthened by a timber buttress, having a flat crest or platform.

The discharge over the dam proper has been computed, using coefficients derived from experiments on a dam having a similar cross-section, with a slope 2:1 on the upstream face, while the

(a) See Water Supply and Irrigation Paper, U. S. G. S., No. 36, p. 131.

discharge over the flat platform has been computed from an experiment on a somewhat similar broad-crested weir.

The entire flow of Black River at this point, aside from leakage and a slight diversion for municipal water supply of Watertown, passes over the Huntingtonville dam. Two or more readings of the crest gauge are taken daily, and the mean of all readings from midnight to midnight has been used in estimating the mean daily flow. In computing the flow over the dam, an allowance of 200 second-feet has been made for leakage through seams and crevices in the limestone rock underlying the dam. This amount has been arrived at from an estimate of the size of the orifices and the head of the same, when the water was drawn down in the summer of 1897.

There is no opportunity for directly checking the flow, during high water, immediately below the dam. A current meter measurement was made at Glen Park bridge on June 6, 1900, which gave a total flow of 2,175 second-feet. The mean daily flow is given in the following table. It does not represent the full water yielding capacity of the tributary drainage area, inasmuch as a portion of the flow from the headwaters is diverted to the Forestport feeder to supply Black River canal. Storage reservoirs, to compensate water power users, are maintained by the State of New York on Beaver and Moose Rivers, the principal tributaries of Black River. These are described in connection with gauging stations on the streams named.

Reservoirs and lakes on the headwaters of Black River and Woodhull Creek are also utilized for storage for the supply of Boonville feeder of Black River canal, affording a total water surface area of 6 square miles, receiving drainage from 267 square miles of watershed and having a total storage capacity of 1,220,155,000 cubic feet.[a]

Measurements of the amount of diversion from Black River below Forestport reservoir, made in connection with the Barge Canal Survey are described on page 434 of this report.

(a) See Report of New York Barge Canal Survey, 1901, pp. 666-672.

Above Lyons Falls the watershed of Black River is mountainous and largely timbered. At Lyons Falls, Black River is joined by Moose River, and the two flow over a declivity in limestone rock of 67 feet. From the foot of Lyons Falls to Carthage, a distance of 29 miles, the stream flows through in broad drift filled valley, the current is sluggish, and the river is utilized for slackwater navigation. From Carthage to the mouth of the stream, a distance of 25 miles, the stream channel is mostly underlaid by limestone rock, affording numerous ledges utilized as sites for dams, making the stream of great importance as a source of water power. There are 22 dams in this section, furnishing roundly 60,000 horse power to 80 mills along the banks, which employ an aggregate of 3,900 persons.([a])

On the morning of April 21, 1900, the calculated discharge over the Huntingtonville dam was 30,150 second-feet, equivalent to a flow of 16 second-feet per square mile of tributary watershed. December 15, 1901, heavy rainfalls on frozen ground produced a freshet, yielding a calculated discharge of over 37,000 second-feet at the Huntingtonville dam or 19.2 second-feet per square mile.

(a) Black River Water Power is fully described in Report of U. S. Board of Engineers on Deep Waterways, Vol. 2, pp. 841-868.

Mean Daily Flow in Second-feet of Black River at Huntingtonville Dam, N. Y.

[Drainage area, 1,8[illegible] square miles.]

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1897.												
1	......	......	1,920	8,000	8,850	[illegible]	878	1,710*	......	......	880	6,
2	......	......	......	8,170	7,000*	[illegible]	868	1,600	......	......	872	6,
3	......	......	......	8,000	6,514	[illegible]	1,066	1,510	......	......	1,720	2,
4	......	......	......	6,170*	5,100	[illegible]	880*	1,391	......	......	2,610	2,
5	......	......	2,080	8,021	6,000	[illegible]	780	860	......	......	2,800	6,
6	......	......	2,088	8,680	6,310	2,000*	846	780	......	......	1,080	4,
7	......	......	3,370*	9,000	5,970	2,070	1,066	680	......	......	1,800*	6,
8	......	......	5,304	10,910	4,730	2,600	710	660*	......	......	2,130	6,
9	......	......	3,000	11,640	5,700*	3,040	670	640	......	......	2,130	6,
10	......	......	4,080	11,640	3,900	4,404	744	420	......	......	2,000	5,
11	......	......	3,050	10,800*	3,900	6,170	880*	2,080	......	......	4,674	7,
12	......	......	5,910	8,700	3,400	6,430	860	3,013	......	......	4,411	7,
13	......	......	6,092	7,340	3,815	5,970*	800	7,363	......	......	4,080	7,
14	......	......	5,400*	6,886	5,000	4,411	614	5,030	......	1,044	4,000*	6,
15	......	......	5,050	7,130	4,303	5,800	1,110	5,430*	......	1,320	3,670	7,
16	......	......	6,130	7,900	5,170*	5,770	1,180	3,303	......	2,430	3,600	6,
17	......	......	4,300	6,310	4,003	2,434	1,110	1,710	......	804*	4,130	6,
18	......	......	3,920	9,040*	4,125	3,000	1,000*	3,020	......	1,176	5,170	6,
19	......	......	3,000	9,400	3,000	1,064	904	2,434	......	1,110	5,210	6,
20	......	......	3,310	9,800	5,000	1,400*	970	1,004	......	900	3,000	6,
21	......	......	3,600*	9,600	5,405	3,000	1,000	1,300	......	874	2,900*	6,
22	......	1,400	8,350	9,300	3,043	2,700	800	†1,000*	......	840	3,000	6,
23	......	1,400	10,916	8,300	5,085*	2,370	780	670	......	780	3,000	6,
24	......	3,010	14,300	7,040	2,430	1,064	680	604	......	640*	2,100	3,
25	......	1,400	4,250	9,104*	3,513	1,300	480*	630	......	630	1,000	3,
26	......	3,430	13,000	11,176	6,000	1,100	1,000	600	......	740	6,900	3,
27	......	......	10,700	13,640	4,770	870*	904	602	......	780	6,316	3,
28	......	......	7,800*	4,103	4,374	1,100	800	600	......	834	9,140*	3,
29	......	......	6,176	13,000	4,000	870	1,200	1,300*	......	710	9,000	2,
30	......	......	5,480	10,800	3,770*	806	1,900	......	......	710	6,316	3,
31	......	......	5,450	......	3,000	......	2,000	......	......	670*	......	1,
Mean	......	3,160	6,317	8,414	4,407	3,710	870	1,800	......	804	4,130	4,720
1898.												
1	1,720	3,770	2,800	7,010	4,417*	3,770	1,400	1,110	1,364	1,000	3,000	3,540
2	2,370*	3,000	3,010	6,040	3,000	3,900	1,016	1,000	1,120	1,000*	3,700	3,400
3	1,940	3,000	3,300	5,000*	5,530	3,000	672*	1,100	1,110	1,000	3,010	3,000
4	3,000	3,610	3,300	3,910	3,700	1,004	800	1,300	800*	1,110	3,300	3,500*
5	3,110	3,770	3,190	3,900	3,915	1,730*	1,110	1,400	1,340	3,412	3,300	3,300
6	3,000	3,400*	3,190*	3,800	4,770	1,540	1,005	1,400	1,700	2,770	4,410*	3,000
7	1,900	2,610	3,100	3,430	4,411	1,502	1,178	1,710*	1,004	2,430	3,005	1,900
8	1,870	3,610	3,310	3,300	5,400*	1,500	1,030	1,000	2,000	2,765	3,000	1,806
9	1,800*	3,480	3,474	3,006	3,770	1,170	900	1,304	1,900	1,910*	3,900	1,600
10	1,806	2,400	3,430	3,000*	2,930	1,304	720*	1,110	1,004	1,000	3,900	1,604
11	1,804	5,190	6,006	3,070	2,435	1,404	800	1,110	1,400*	1,404	3,404	1,300*
12	1,700	5,900	13,300	3,600	1,900	1,304*	1,000	1,176	1,404	1,304	3,340	1,804
13	2,000	5,104*	15,300*	3,043	3,000	1,300	1,000	1,310	1,200	1,300	3,104*	1,804
14	4,000	7,340	25,300	2,700	3,000	1,004	970	1,300*	904	1,400	3,730	1,600
15	4,005	6,470	27,000	3,000	3,500*	3,130	1,000	600	1,000	3,700	7,470	1,600
16	4,440*	5,480	23,700	3,007	2,043	2,000	1,000	1,314	690	5,000*	6,170	1,600
17	4,300	4,430	17,000	3,040*	3,510	1,004	800*	1,000	673	4,411	4,000	2,000
18	5,000	3,000	14,000	3,340	3,500	1,340	1,030	800	800*	3,775	3,000	1,600*
19	5,500	3,000	13,730	3,340	2,130	1,194*	1,035	800	600	3,000	3,300	1,600
20	5,430	3,300*	13,304*	4,006	3,040	1,000	1,134	804	610	3,700	3,000*	2,000
21	6,400	3,773	12,804	3,775	3,063	2,100	1,300	800*	1,120	2,074	3,304	2,000
22	6,400	3,000	10,343	4,300	3,700*	3,000	1,500	816	1,004	3,900	3,704	2,540
23	5,600*	3,913	13,013	3,300	2,434	1,304	1,500	1,110	890	4,374*	3,000	4,300
24	6,170	5,400	11,280	5,000*	3,540	1,040	900*	1,180	1,440	5,400	3,304	5,610
25	5,070	5,300	9,300	7,304	3,770	1,340	1,300	2,610	3,700*	4,000	3,900	5,400
26	3,500	5,900	8,300	6,900	3,900	1,320*	2,400	3,000	3,000	4,005	2,043	5,100*
27	4,730	5,770*	6,900*	10,140	3,775	1,000	1,710	3,180	3,740	3,570	1,600*	4,300
28	5,300	5,000	6,170	9,000	4,000	1,340	1,340	2,700*	3,000	6,000	3,000	5,400
29	3,500	......	5,300	7,700	5,000*	1,316	1,304	2,000	2,770	6,500	3,301	5,000
30	3,100*	......	7,040	6,500	5,300	1,304	1,900	1,400	1,800	5,300*	3,010	5,700
31	3,100	......	7,000	......	5,140	......	1,103*	1,600	......	5,300	......	4,013
Mean	3,440	4,506	9,000	6,004	3,174	1,600	1,130	1,606	1,400	3,130	3,600	3,700

*Sunday. † Water drawn down for repairs, beginning August 22.

Mean Daily Flow in Second-feet of Black River at Huntingtonville Dam, N. Y.—(Continued).

*Sunday. † Sluice gates open.

Mean Daily Flow in Second-feet of Black River at Huntingtonville Dam, N. Y.—Concluded.

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2,225	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2,435
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2,532	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	[illegible]	5,430	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3,315	[illegible]
14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	*
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	*
16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......
17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......
18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......
19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......
20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......
21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......
22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	*
23	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3,345	[illegible]	......
24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2,300	[illegible]	[illegible]	[illegible]	......
25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1,550	[illegible]	[illegible]	......
26	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1,850	[illegible]	[illegible]	......
27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1,735	2,610*	[illegible]	......
28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1,580	2,455	3,013	......
29	[illegible]	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2,552	3,085	*
30	[illegible]	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2,610	2,376	2,950	......
31	[illegible]	......	[illegible]	......	[illegible]	......	4,454	2,530	......	2,073	......	......
Mean	2,544	2,12.	6,024	14,354	5,007	5,316	1,626	2,135	3,089	3,316	2,712	......

* Sunday. † Dam injured by high water.

Mean Monthly Run-off of Black River at Huntingtonville Dam, N. Y.

[Drainage area, 1,889 square miles.]

MEAN MONTHLY FLOW IN SECOND-FEET

MONTH.	1897.	1898.	1899.	1900.	1901.
January	....	3,402	4,712	2,834	2,844
February	2,160	3,866	2,326	5,734	2,421
March	6,317	9,609	5,051	2,970	6,024
April	9,484	4,651	13,894	13,946	14,354
May	4,267	3,174	5,639	5,711	5,007
June	2,713	1,639	1,528	1,630	5,316
July	879	1,128	1,205	1,321	1,626
August	2,230	1,495	697	1,134	2,135
September	......	1,483	990	1,020	3,089
October	954	3,138	1,018	1,218	3,316
November	4,155	3,932	1,652	5,014	2,712
December	4,725	2,720	3,501	4,280	....
Year	....	....	....	....	....

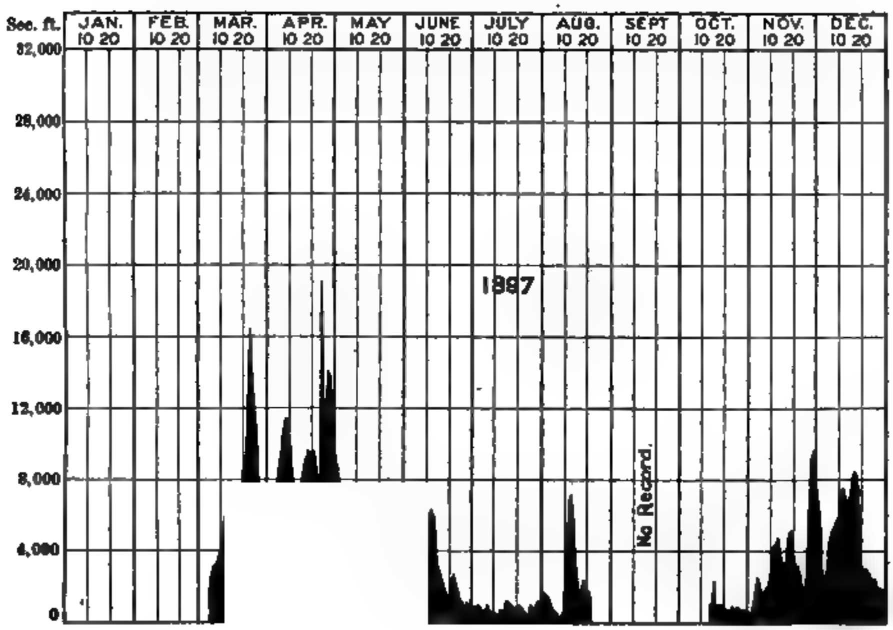

Fig. No. 4.—Discharge of Black River at Huntingtonville Dam, Jefferson County, N. Y., 1897

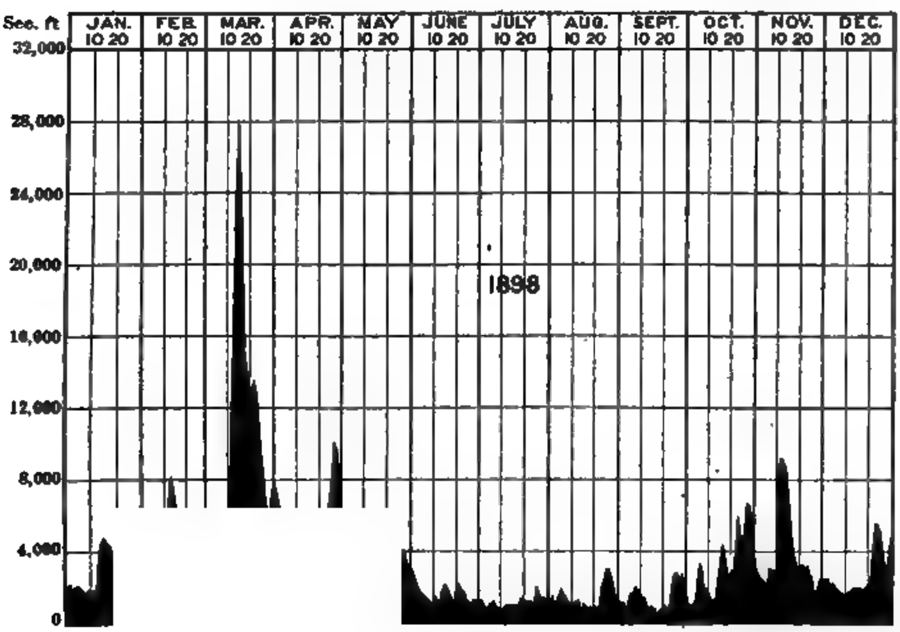

Fig. No. 5.—Discharge of Black River at Huntingtonville Dam, Jefferson County, N. Y., 1898.

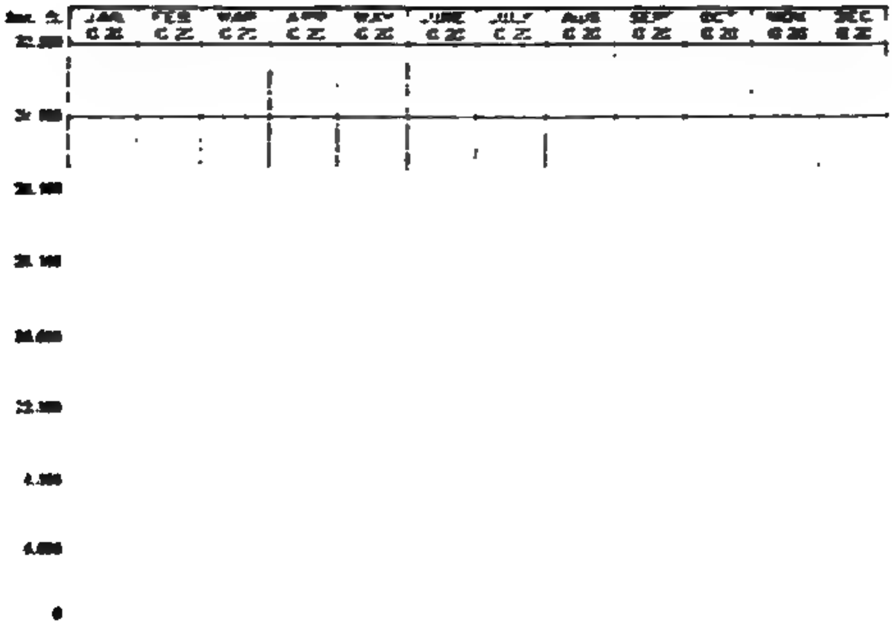

Fig. No. 6.—Discharge of Black River at Huntingtonville Dam, Jefferson County, N. Y., [illegible]

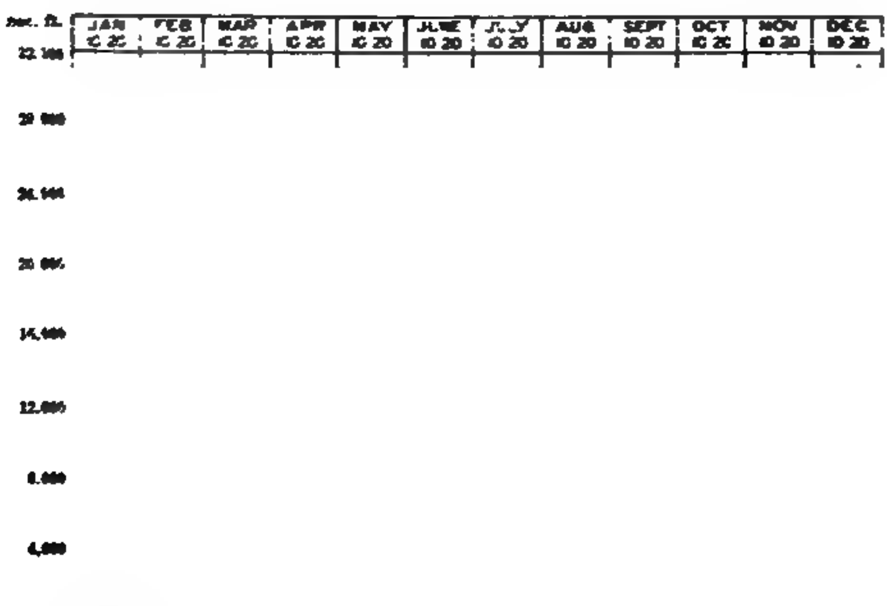

Fig. No. 7.—Discharge of Black River at Huntingtonville Dam, Jefferson County, N. Y., [illegible]

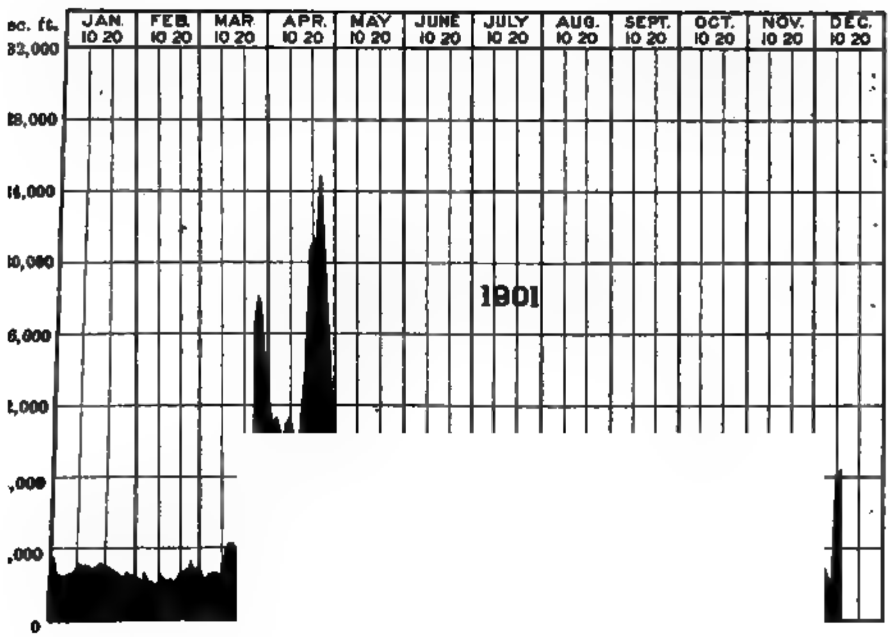

Fig. No. 3.—Discharge of Black River at Huntingtonville Dam, Jefferson County, N. Y., 1901.

Mean Monthly Run-Off of Black River at Huntingtonville Dam, N. Y.—(Concluded.)

SECOND-FEET PER SQUARE MILE.

MONTH.	1897.	1898.	1899.	1900.	1901.
January	....	1.18	2.49	1.50	1.50
February	1.14	2.01	1.23	3.04	1.28
March	3.84	5.08	2.67	1.57	3.18
April	5.02	2.46	7.35	7.37	7.60
May	2.26	1.68	2.97	3.03	2.65
June	1.44	0.87	0.81	0.86	2.81
July	0.47	0.60	0.64	0.70	0.86
August	1.21	0.79	0.47	0.60	1.13
September	....	0.78	0.52	0.54	1.68
October	0.505	1.66	0.54	0.64	2.28
November	2.20	2.08	0.87	2.65	1.43
December	2.50	1.44	1.85	2.24	....
Year	....	....	....	....	....

INCHES ON DRAINAGE AREA.

MONTH.	1897.	1896.	1899.	1900.	1901.
January	....	1.36	2.77	1.73	1.73
February	1.18	2.09	1.28	3.16	1.33
March	3.85	5.77	3.08	1.81	3.66
April	5.60	2.74	8.20	8.22	8.51
May	2.60	1.86	3.42	3.48	3.05
June	1.60	0.97	0.90	0.96	3.15
July	0.54	0.69	0.73	0.80	0.99
August	1.39	0.91	0.54	0.69	1.30
September	....	0.87	0.58	0.60	1.83
October	0.58	1.91	0.60	0.71	2.62
November	2.45	2.32	0.97	2.96	1.60
December	2.88	1.66	1.52	2.58	....
Year	....	....	....	....	....

Estimated Flood Discharge of Black River in April, 1869. *a*

LOCATION.	Estimated discharge, second-feet.	Drainage area, square miles.	Second-feet per square mile.
Forestport	10,450	268	39
Lyons Falls	40,400	873	46
Carthage	39,529	1,812	21
Four Miles below Carthage	39,009	1,824	21
Below Black River	39,187	1,869	21
Watertown	39,696	1,892	21
Ontario Paper Mill	28,337	1,908	15

a From data by L. L. Nichols, Black River Water Claims, Vol. 1, p. 640.

SALMON RIVER, ABOVE PULASKI, OSWEGO COUNTY, N. Y.

Salmon River rises in Lewis county, flows westward across Jefferson county, and enters the east end of Lake Ontario, near Pulaski. A current meter station was established on this stream, September 5, 1900. It is located at a highway bridge, locally called Fox bridge, two miles above the village of Pulaski.

The stream bed is of gravel and cobblestone, nearly flat. The gauge board is attached to the central pier of the bridge, and is divided in feet and decimals, from zero to 10 feet. Gauge readings are taken each morning and evening, by Hiram A. Walker. The capstone of the central pier, above the gauge, is used as a bench mark.

Elevation bench mark 100.00
Elevation gauge zero....................... 87.41

The stream has a flood-plain on the left-hand side, over which the water passes during freshets. The average elevation of the flood-plain is 7.5 feet above gauge zero. There are two auxiliary channels spanned by short bridges, through which the water passes at times. The flow through these is included in the high water discharge measurements given below.

Current Meter Discharge Measurements of Salmon River near Pulaski, N. Y.

DATE.	Gauge height, feet.	Discharge second-feet.	Hydrographer.
September 4, 1900	1.08	103	R. E. Horton.
May 2[illegible], 1901	1.69	422	J. D. Luther.
May 13, 1901	2.14	826	R. E. Horton.
June [illegible], 1901	2.50	1,070	J. D. Luther.
April 12, 1901	3.49	2,536	R. E. Horton.
June [illegible], 1901	4.20	3,457	J. D. Luther.
April 24, 1901	4.50	3,476	R. E. Horton.

A current meter measurement of Salmon River at Stillwater bridge was made November 2, 1898, by W. D. Lockwood, the discharge being 403 second-feet.

Drainage Areas Tributary to Salmon River.

LOCATION.	Square miles.
Gauging station near Salmon Falls	197
Gauging station near Pulaski	264
Mouth of stream	285

Summary of Developed Water Powers on Salmon River.

No. of dam.	LOCATION.	Number of mills.	Head in feet.	H. P. of water wheels.	Number of operatives employed.	Manufacture.
1	Pulaski	2	10	136	10	Electric lighting, furniture.
2	Pulaski	1	4	30	2	Grist mill.
3	Pulaski	4	4–9	76	15	Woodworking, etc.
4	Pulaski	6	10–13	84	22	Wood and iron working and woolen mill.
5	Altmar	2	5–7	119	4	Grist and planing mills.
6	Stillwater	1	6	6	10	Saw mill.

Mean Daily Flow in Second Feet of Salmon River at Pulaski, N. Y.

[Drainage area, 264 square miles.]

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1900.												
1	......	......	......	......	......	......	......	......	......	394	186	1,075
2	......	......	......	......	......	......	......	......	......	330	186	905
3	......	......	......	......	......	......	......	......	......	258	554	820
4	......	......	......	......	......	......	......	......	......	210	522	1,075
5	......	......	......	......	......	......	......	......	......	186	490	1,357
6	......	......	......	......	......	......	......	......	100	114	586	1,082
7	......	......	......	......	......	......	......	......	100	188	586	905
8	......	......	......	......	......	......	......	......	100	258	1,357	777
9	......	......	......	......	......	......	......	......	100	554	1,181	426
10	......	......	......	......	......	......	......	......	100	522	862	330
11	......	......	......	......	......	......	......	......	75	394	586	330
12	......	......	......	......	......	......	......	......	75	330	586	262
13	......	......	......	......	......	......	......	......	75	282	522	282
14	......	......	......	......	......	......	......	......	75	282	522	282
15	......	......	......	......	......	......	......	......	75	234	458	258
16	......	......	......	......	......	......	......	......	100	262	330	234
17	......	......	......	......	......	......	......	......	100	282	330	234
18	......	......	......	......	......	......	......	......	100	282	458	234
19	......	......	......	......	......	......	......	......	100	258	1,131	394
20	......	......	......	......	......	......	......	......	100	258	3,541	618
21	......	......	......	......	......	......	......	......	777	234	3,748	282
22	......	......	......	......	......	......	......	......	862	210	2,566	306
23	......	......	......	......	......	......	......	......	490	210	1,777	394
24	......	......	......	......	......	......	......	......	426	306	1,082	862
25	......	......	......	......	......	......	......	......	862	650	1,075	1,075
26	......	......	......	......	......	......	......	......	258	618	2,325	990
27	......	......	......	......	......	......	......	......	210	554	4,656	820
28	......	......	......	......	......	......	......	......	210	554	2,727	820
29	......	......	......	......	......	......	......	......	210	458	2,119	735
30	......	......	......	......	......	......	......	......	306	490	1,131	820
31	......	......	......	......	......	......	......	......	......	490	......	905
Mean	......	......	......	......	......	......	......	......	219	343	1,267	641
1901.												
1	†	†	†	1,344	1,640	1,301	306	458	5,276	1,301	586	282
2	......	......	......	1,357	3,439	1,131	282	362	2,051	990	426	426
3	......	......	......	1,777	1,244	1,188	282	258	1,301	1,131	362	330
4	......	......	......	2,566	1,075	1,588	282	234	735	1,470	306	306
5	......	......	......	2,405	1,082	2,051	282	186	554	1,470	330	382
6	......	......	......	2,727	947	1,527	306	186	458	1,131	330	282
7	......	......	......	3,130	650	1,131	330	330	394	1,082	330	234
8	......	......	......	2,727	490	4,057	394	262	362	905	282	234
9	......	......	......	2,727	458	2,486	455	258	306	820	282	258
10	......	......	......	2,727	490	1,301	426	490	282	1,244	282	241
11	......	......	......	2,119	947	1,131	394	522	362	650	306	3,954
12	......	......	......	3,130	862	905	330	490	490	394	1,414	2,188
13	......	......	......	2,308	862	618	306	394	905	777	4,284	2,325
14	......	......	......	2,119	785	490	306	330	258	1,470	2,256	4,284
15	......	......	......	4,057	618	458	282	282	618	1,131	1,357	†
16	......	......	......	4,408	554	426	282	306	1,914	1,082	1,131	†
17	......	......	......	4,656	650	394	258	262	1,075	1,527	1,075	†
18	......	......	......	*	554	394	234	234	947	1,640	990	3,645
19	......	......	......	5,276	490	426	186	234	785	1,470	948	1,914
20	......	......	......	......	458	394	186	234	522	1,188	863	1,132
21	......	......	......	*	490	1,527	188	234	458	947	778	948
22	......	......	......	*	426	905	188	186	394	905	618	735
23	......	......	......	*	618	1,470	188	306	394	777	778	490
24	......	......	......	4,656	554	905	188	990	362	458	820	490
25	......	......	......	3,954	586	1,344	188	586	330	554	650	426
26	......	......	......	3,233	458	905	188	426	330	522	586	394
27	......	......	......	2,486	490	490	188	306	282	458	522	394
28	......	......	......	2,486	618	394	188	234	282	458	394	330
29	......	......	......	1,952	947	362	426	186	282	458	330	778
30	......	......	......	1,708	990	362	554	490	947	453	330	990
31	......	......	......	......	1,301	......	490	3,954	......	458	......	554
Mean	......	......	......	2,894	829	1,065	281	460	787	943	798	930

* Exceeds limit of rating curve. † Stream obstructed by ice.

Mean Monthly Run-off of Salmon River at Pulaski, N. Y.

[Drainage area 264 square miles.]

MONTH.	SECOND-FEET.		SECOND-FEET PER SQUARE MILE.		INCHES ON DRAINAGE AREA.	
	1900.	1901.	1900.	1901.	1900.	1901.
January	....	....	....	....	....	....
February	....	....	....	....	....	....
March	....	....	....	....	....	....
April	....	2,891	....	10.95	....	12.21
May	....	829	....	3.14	....	3.61
June	....	1,065	....	4.02	....	4.50
July	....	281	....	1.06	....	1.22
August	....	460	....	1.74	....	2.00
September	219	787	.83	2.98	.93	3.34
October	343	943	1.30	3.57	1.50	4.14
November	1,267	798	4.81	3.02	5.39	3.37
December	641	930	2.43	3.52	2.79	4.06

There is an undeveloped water power with a precipitous fall of 110 feet at Salmon Falls. In November, 1898, a gauging station was established by United States Board of Engineers on Deep Waterways, at a dam one mile above these falls. This gauging station was abandoned in June, 1899.[a]

WEST BRANCH OF FISH CREEK AT McCONNELLSVILLE, ONEIDA COUNTY, N. Y.

This stream rises in the northern part of Oneida county and flows in a southerly direction to its junction with the east branch at Taberg station, where it forms the main Fish Creek, which stream flows in a westerly direction, emptying into the east end of Oneida Lake. The lower part of the course of Fish Creek is shown on the Oneida atlas sheet of the United States Geological Survey.

The station is located at the Harden dam in McConnellsville. This dam is of timber, having a slight leakage, which has been estimated at 10 second-feet. The dam is in two sections, forming an angle in plan, the length of the right-hand and left-hand sections being 102.69 feet and 73 feet respectively.

During the summer, when flashboards are on the dam, the Francis formula is used in computing the flow. At other times,

a See description, U. S. Geol. Survey, Water Supply Paper, No. 36, p. 180.

a discharge curve, derived from Cornell University experiments, is used. Three water wheels are in use. Two are 54-inch wheels, built by the Camden Water Wheel Works, and are usaully run 10 hours per day, at a nearly constant gate opening. The third is a 36-inch Helmer turbine.

Current meter measurements of the discharge of one of the 54-inch wheels, as run under light and heavy load, showed the following results:

June 2, 1900............. Discharge 43.2 second-feet.

September 6, 1900........ Discharge 51.8 second-feet.

The gauging record at McConnellsville was discontinued June 30, 1901.

The following data relative to maximum discharges of Fish Creek were obtained for the United States Board of Engineers on Deep Waterways.[a]

LOCATION.	Drainage area square miles.	Date of flood.	ESTIMATED MAXIMUM DISCHARGE.	
			Second-feet.	Second-feet per square mile.
Williamstown *b*	16.2		500	30.9
Williamstown *c*	16.5		561	34.0
West Camden	47.5	Spring, 1884	1,620	34.1
Camden *d*	61.4	June, 1889	1,475	24.1
Camden *e*	61.5		1,417	23.0
Camden *f*	61.5		1,456	23.5
Camden *g*	68.8		1,835	21.9
McConnellsville	187.0	———1884	6,170	32.7
Taberg Station *h*	387.0	March 14, 1898	5,875	15.2
Fish Creek *i*	533.0	March 15, 1898	7,597	14.2
Point Rock *j*	104.3	Fall 1897	8,400	80.5

The maximum discharge observed while the gauging record has beep kept was 4,560 second-feet or 24.4 second-feet per square mile, March 27, 1901.

a Report on Special Water Supply Investigation, Pt. 11, pp. 790-791.

b Upper dam.

c Lower dam.

d Grist Mill dam.

e Foundry dam.

f Plaining Mill dam.

g Dorance's dam.

h Below junction E. and W. branches.

i Below confluence with Wood Creek.

j East Branch.

Mean Daily Flow in Second-feet of West Branch, Fish Creek, at McConnellsville, N. Y.

[Drainage area, 187 square miles.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1898.												
1	.....	.....	.....	.....	.....	.....	.....	.....	.....	137	365	237
2	.....	.....	.....	.....	.....	.....	.....	.....	.....	50*	319	245
3	.....	.....	.....	.....	.....	.....	.....	.....	.....	111	292	217
4	.....	.....	.....	.....	.....	.....	.....	.....	.....*	121	172	195*
5	.....	.....	.....	.....	.....	.....	.....	.....	.....	130	155	153
6	.....	.....	.....	.....	.....	.....	.....	.....	.....	137	120*	152
7	.....	.....	.....	.....	.....	.....	.....	.....	.....	131	146	196
8	.....	.....	.....	.....	.....	.....	.....	.....	.....	122	138	182
9	.....	.....	.....	.....	.....	.....	.....	.....	.....	65*	135	199
10	.....	.....	.....	.....	.....	.....	.....	.....	.....	102	557	180
11	.....	.....	.....	.....	.....	.....	.....	.....	.....*	81	1,562	140*
12	.....	.....	.....	.....	.....	.....	.....	.....	.....	87	997	199
13	.....	.....	.....	.....	.....	.....	.....	.....	100	124	700*	186
14	.....	.....	.....	.....	.....	.....	.....	.....	90	134	784	212
15	.....	.....	.....	.....	.....	.....	.....	.....	96	397	434	162
16	.....	.....	.....	.....	.....	.....	.....	.....	47	360*	514	157
17	.....	.....	.....	.....	.....	.....	.....	.....	47	562	365	147
18	.....	.....	.....	.....	.....	.....	.....	.....	50*	346	363	120*
19	.....	.....	.....	.....	.....	.....	.....	.....	98	227	365	[illegible]
20	.....	.....	.....	.....	.....	.....	.....	.....	81	190	370*	157
21	.....	.....	.....	.....	.....	.....	.....	.....	57	172	371	190
22	.....	.....	.....	.....	.....	.....	.....	.....	55	467	220	287
23	.....	.....	.....	.....	.....	.....	.....	.....	57	700*	316	317
24	.....	.....	.....	.....	.....	.....	.....	.....	332	750	300	468
25	.....	.....	.....	.....	.....	.....	.....	.....	360*	624	329	390*
26	.....	.....	.....	.....	.....	.....	.....	.....	197	434	319	285
27	.....	.....	.....	.....	.....	.....	.....	.....	231	1,097	255*	285
28	.....	.....	.....	.....	.....	.....	.....	.....	181	871	299	225
29	.....	.....	.....	.....	.....	.....	.....	.....	181	686	251	170
30	.....	.....	.....	.....	.....	.....	.....	.....	147	440*	172	120
31	.....	.....	.....	.....	.....	.....	.....	.....	.....	464	.....	120
Mean	.....	.....	.....	.....	.....	.....	.....	.....	134	333	384	211
1899.												
1	120	228	402	556	273	292	58	.....	.....	.....	.....	.....
2	126	183	402	520*	313	307	10*	.....	.....	.....	.....	.....
3	194	183	434	601	243	259	10	.....	.....	.....	.....	.....
4	261	172	595	601	184	150*	10	.....	.....	.....	.....	.....
5	321	120*	700*	601	184	159	95	.....	.....	.....	.....	.....
6	396	212	956	591	184	134	95	.....	.....	.....	.....	.....
7	396	156	856	689	120*	124	95	.....	.....	.....	.....	.....
8	285*	156	700	1,557	183	114	125	.....	.....	.....	.....	.....
9	352	147	856	2,110*	154	114	100*	.....	.....	.....	.....	.....
10	422	136	583	1,690	154	95	77	.....	.....	.....	.....	.....
11	502	117	546	1,724	183	20*	47	.....	.....	.....	.....	.....
12	587	80*	700*	2,055	243	81	47	.....	.....	.....	.....	.....
13	373	99	1,178	2,440	194	81	95	.....	.....	.....	.....	.....
14	873	132	1,178	2,920	120*	107	47	.....	.....	.....	.....	.....
15	795*	94	1,178	3,040	189	76	47	.....	.....	.....	.....	.....
16	787	181	972	2,410*	189	72	10*	.....	.....	.....	.....	.....
17	735	148	782	1,720	169	57	95	.....	.....	.....	.....	.....
18	615	133	567	1,644	169	20*	95	.....	.....	.....	.....	.....
19	615	120*	485*	1,484	374	102	95	.....	.....	.....	.....	.....
20	530	188	505	1,174	374	102	58	.....	.....	.....	.....	.....
21	495	198	488	1,085	255*	97	58	.....	.....	.....	.....	.....
22	360*	258	444	1,045	303	65	21	.....	.....	.....	.....	.....
23	314	338	443	940*	244	85	10*	.....	.....	.....	.....	.....
24	425	438	442	664	194	75	47	.....	.....	.....	.....	.....
25	350	438	442	564	189	10*	47	.....	.....	.....	.....	.....
26	325	360*	360*	470	174	47	47	.....	.....	.....	.....	.....
27	338	403	552	366	134	47	47	.....	.....	.....	.....	.....
28	308	408	599	366	50*	47	47	.....	.....	.....	.....	.....
29	225*	.....	599	364	700	97	10	.....	.....	.....	.....	.....
30	273	.....	599	220*	455	97	10*	.....	.....	.....	.....	.....
31	278	.....	599	.....	483	.....	95	.....	.....	.....	.....	.....
Mean	435	206	648	1,206	239	101	57	.....	.....	.....	.....	.....

*Sundays.

Mean Daily Flow in Second-feet of West Branch, Fish Creek, at McConnellsville, N Y.—(Concluded).

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1900.												
1	......	......	......	......	278	96	52*	60	48	69	157	160
2	......	......	......	......	255	78	78	60	10*	54	144	117*
3	......	......	......	......	232	25*	78	60	20	49	133	144
4	......	......	......	......	243	70	52	58	50	65	93*	122
5	......	......	......	......	243	58	52	10*	50	65	132	257
6	......	......	......	......	205*	70	96	50	60	64	104	201
7	......	......	......	......	225	70	80	50	60	34*	148	169
8	......	......	......	......	165	88	52*	50	28	89	217	150
9	......	......	......	......	185	90	78	50	10*	89	180	117*
10	......	......	......	......	185	52*	78	58	50	59	163	118
11	......	......	......	......	185	78	78	50	50	55	110*	133
12	......	......	......	......	172	70	70	80*	60	54	107	127
13	......	......	......	......	105*	60	70	56	60	64	107	127
14	......	......	......	......	148	68	60	168	60	36*	132	137
15	......	......	......	......	140	78	10*	98	58	71	112	97
16	......	......	......	......	185	56	60	61	10*	76	101	52*
17	......	......	......	......	125	52*	60	64	60	76	86	121
18	......	......	......	......	120	72	70	48	60	46	78*	112
19	......	......	......	......	106	58	60	19*	55	86	144	95
20	......	......	......	......	75*	78	60	80	55	71	207	58
21	......	......	......	......	104	70	60	50	196	60*	224	50
22	......	......	......	......	104	70	10*	50	239	106	239	28
23	......	......	......	......	96	68	60	60	128*	116	246	31*
24	......	......	......	......	96	28*	50	55	87	218	231	31
25	......	......	......	......	86	70	64	80	87	148	196*	31
26	......	......	......	......	86	70	60	19*	66	134	330	31
27	......	......	......	......	88*	70	76	90	66	140	355	51
28	......	......	......	......	82	70	26	184	66	128*	223	51
29	......	......	......	......	71	70	36*	76	50	150	187	31
30	......	......	......	......	52	68	60	50	58*	150	179	31*
31	......	......	......	......	88	......	60	50	......	206	......	58
Mean	......	......	......	......	143	68	60	57	65	88	168	99
1901.												
1	150	185	95	620	170	478	......	......	......	......	......	......
2	150	135	85	545	170	540*	......	......	......	......	......	......
3	150	100*	50*	915	140	510	......	......	......	......	......	......
4	115	185	86	1,420	140	440	......	......	......	......	......	......
5	115	110	88	1,520	120*	355	......	......	......	......	......	......
6	100*	130	85	1,210	110	690	......	......	......	......	......	......
7	111	110	85	1,070*	110	710	......	......	......	......	......	......
8	111	110	88	1,165	95	878	......	......	......	......	......	......
9	111	110	75	1,060	90	690*	......	......	......	......	......	......
10	116	65*	45*	980	90	680	......	......	......	......	......	......
11	111	110	115	695	340	570	......	......	......	......	......	......
12	111	61	150	620	460*	520	......	......	......	......	......	......
13	100*	95	170	630	345	470	......	......	......	......	......	......
14	180	95	190	620*	220	375	......	......	......	......	......	......
15	125	95	250	540	170	368	......	......	......	......	......	......
16	121	95	250	470	120	335*	......	......	......	......	......	......
17	121	80*	230*	425	120	360	......	......	......	......	......	......
18	111	85	290	420	126	320	......	......	......	......	......	......
19	106	100	290	390	100*	310	......	......	......	......	......	......
20	110*	100	344	358	180	310	......	......	......	......	......	......
21	136	100	580	560*	130	1,060	......	......	......	......	......	......
22	146	90	815	670	160	833	......	......	......	......	......	......
23	136	90	730	655	180	620*	......	......	......	......	......	......
24	111	65*	730*	530	185	440	......	......	......	......	......	......
25	111	90	1,050	460	298	310	......	......	......	......	......	......
26	111	30	3,020	315	200*	200	......	......	......	......	......	......
27	100*	90	4,410	258	230	170	......	......	......	......	......	......
28	111	90	2,180	230*	220	170	......	......	......	......	......	......
29	125	......	1,165	235	230	118	......	......	......	......	......	......
30	125	......	960	170	355	100*	......	......	......	......	......	......
31	105	......	780*	......	420	......	......	......	......	......	......	......
Mean	119	97	625	657	192	463	......	......	......	......	......	......

* Sundays.

Principal Developed Water Powers on West Branch, Fish Creek.

No. of dam.	LOCATION OF DAM.	No. of mills at dam.	Effective head Feet.	Rated H. P. of water wheels.	Number of employees.	Use made of power.
1	Taberg	1	8	....	....	Saw mill.
2	McConnellsville	2	6	111	40	Wood working.
3	Camden	4	7–9	114	22	Wood working.
4	Camden	2	9–10	136	220	Foundry and knitting mill.
5	Camden	1	10	157	2	Grist mill.
6	Camden	1	5	53	2	Saw and grist mill.
7	West Camden	2	5	92	21	Chair factory.
8	Williamstown	2	16	66	5	Saw and grist mill.
9	Williamstown	1	9	185	4	Grist mill.

A current meter measurement of East branch of Fish Creek was made at Wilson's bridge one mile above Point Rock village, May 17, 1900; the discharge was 485 second-feet.

Mean Monthly Run-off of West Branch of Fish Creek at McConnellsville, N. Y.

[Drainage area 187 square miles.]

MEAN MONTHLY FLOW IN SECOND-FEET.

MONTH.	1898.	1899.	1900.	1901.
January	....	435	....	119
February	....	206	....	97
March	....	648	....	625
April	....	1,206	....	657
May	....	239	143	192
June	....	101	68	465
July	....	57	60	....
August	....	....	57	....
September	134	....	65	....
October	333	....	86	....
November	383	....	168	....
December	211	....	99	....

SECOND-FEET PER SQUARE MILE.

MONTH.	1898.	1899.	1900.	1901.
January	....	2.33	....	0.64
February	....	1.10	....	0.52
March	....	3.47	....	3.34
April	....	6.46	....	3.51
May	....	1.28	0.76	1.03
June	....	0.54	0.36	2.48
July	....	0.30	0.32	....
August	....	....	0.30	....
September	0.72	....	0.34	....
October	1.78	....	0.46	....
November	2.06	....	0.90	....
December	1.13	....	0.53	....

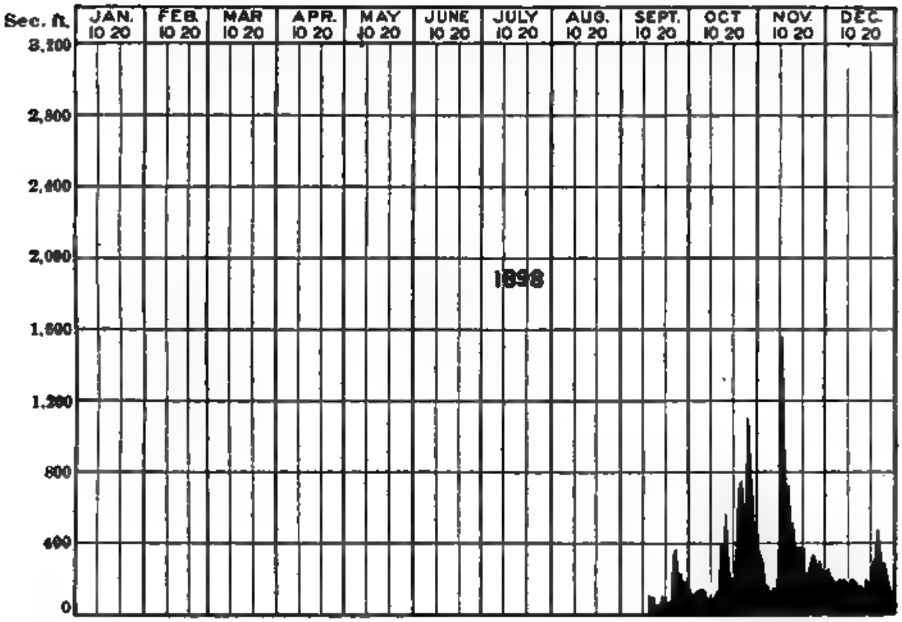

Fig. No. 9.—Discharge of West Branch of Fish Creek at McConnellsville, Oneida County, N. Y., 1898.

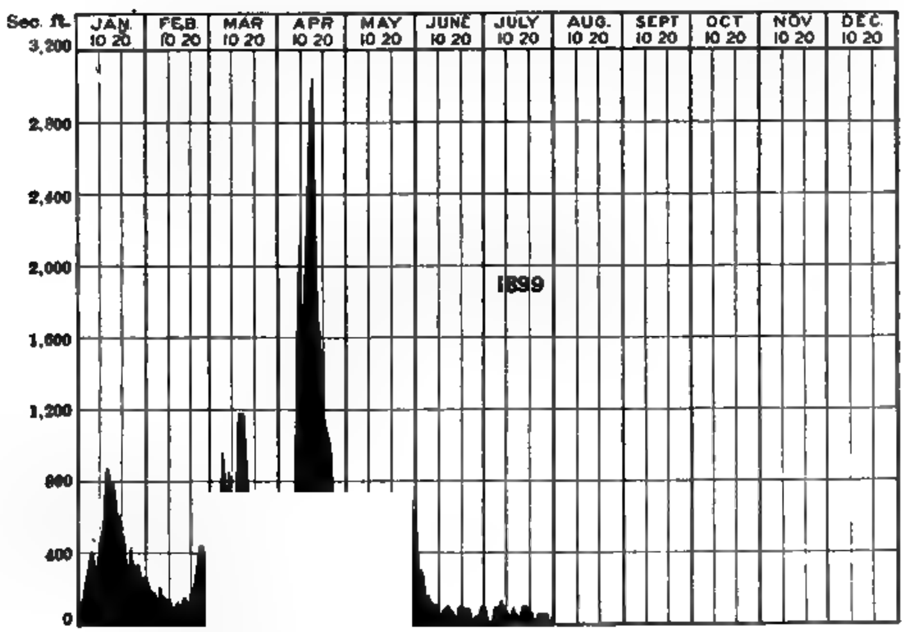

Fig. No. 10.—Discharge of West Branch of Fish Creek at McConnellsville, Oneida County, N. Y., 1899.

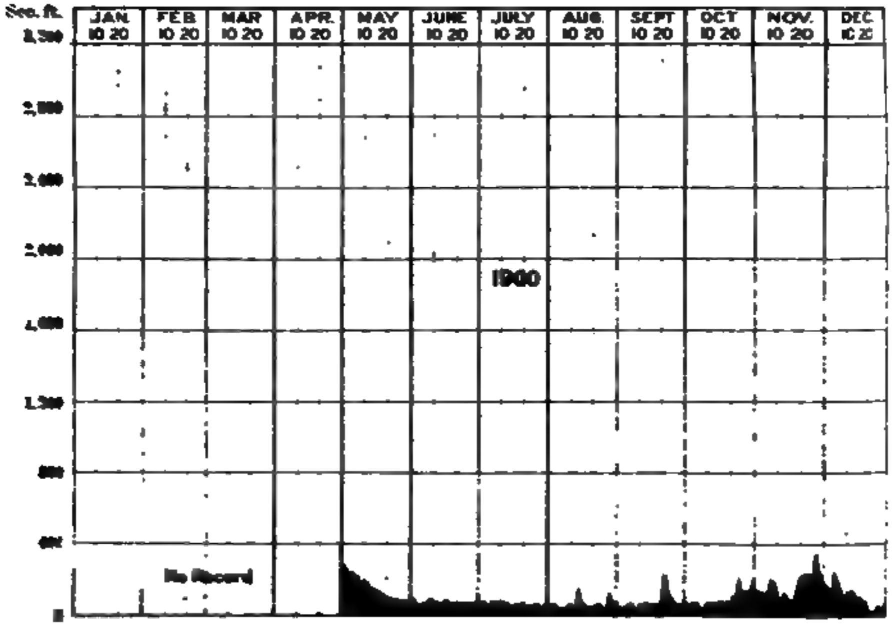

Fig. No. [illegible].—Discharge of West Branch of Fish Creek at McConnellsville, Oneida County, N. Y., 1900.

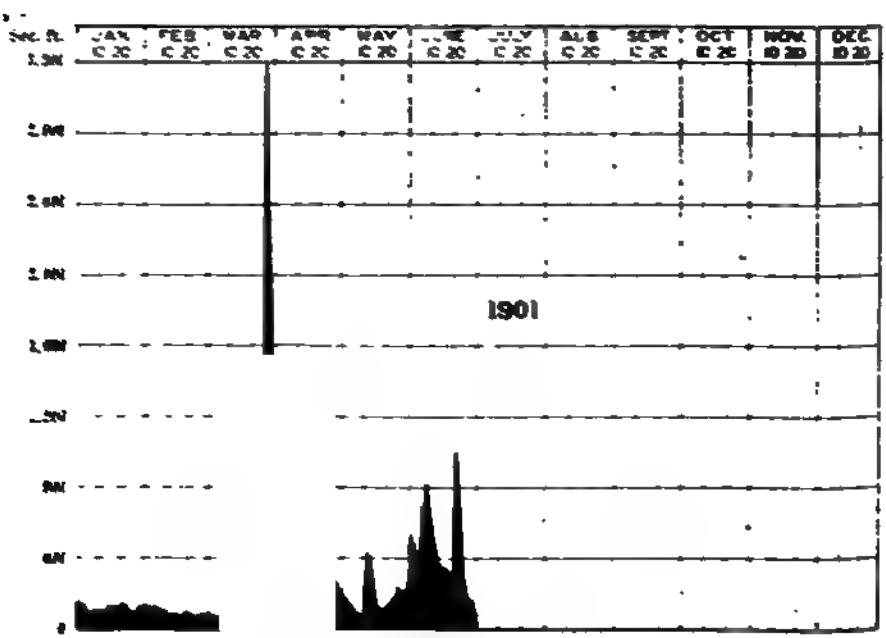

Fig. No. [illegible].—Discharge of West Branch of Fish Creek at McConnellsville, Oneida County, N. Y., 1901.

Mean Monthly Run-off of West Branch of Fish Creek at McConnellsville, N. Y.—(Concluded).

INCHES ON DRAINAGE AREA.

MONTH.	1898.	1899.	1900.	1901.
January	....	2.68	....	0.74
February	....	1.14	....	0.54
March	....	4.00	....	3.84
April	....	7.20	....	3.98
May	....	1.47	0.87	1.18
June	....	0.60	0.40	2.78
July	....	0.34	0.37	....
August	....	....	0.34	....
September	0.80	....	0.38	....
October	2.07	....	0.48	....
November	2.30	....	1.01	....
December	1.30	....	0.63	....

ONEIDA CREEK AT KENWOOD, MADISON COUNTY, N. Y.[a]

This stream rises in Madison county and flows in a northwesterly direction, crossing the Erie canal and emptying into Oneida Lake at its southeastern extremity. It is shown on the Oneida atlas sheet of the United States Geological Survey. The station is located at the dam of Oneida Community at Kenwood, which is of framed timber, having a level crest 79.4 feet in length.

Water is conducted to the mill in an open earth canal, terminating near the silk mill. A short, circular wooden flume conducts water from the headrace to the 24-inch Hercules turbine, which is ordinarily run at one-third gate. There is no leakage of the dam, and only a slight leakage of flume and headgates. This has been taken at 2 second-feet. The flow over a wasteway near the mill is computed by means of the Francis formula. A discharge curve for a second spillway has been prepared, using coefficients from the Cornell experiments for dam with a broad, flat crest.[b]

Current meter measurements, to check the calculated flow at Kenwood, have been made with results as follows:

	Second-feet.
June 1, 1900; total flow at Oneida Castle	36.6
Flow over dam, crest gauge reading, 0.15	19
Flow through turbine, 11.75 head, one-third gate	15
Flow over wasteway near mill	1
Assumed leakage	2
Computed total flow	37
September 17, 1900; total flow measured in headrace	20

a See Water Supply and Irrigation Paper, U. S. G. S., No. 36, p. 136.
b See Trans. Am. Soc. C. E., Vol. XLIV, p. 277.

	Second-feet.
Flow through turbine, one-third gate	15
Assumed leakage	2
Total flow computed	17

At Oneida is a State dam diverting water for the supply of the summit level of Erie canal. No measurements of diversion to the feeder have been made. Practically the entire flow of Oneida Creek, less leakage of the dam, is taken for this purpose during the low water season.

The highest recorded freshet on Oneida Creek occurred in 1892. The calculated discharge over Kenwood dam was 3,292 second-feet or 41.2 second-feet per square mile. December 15, 1901, a sudden freshet, resulting from excessive rainfall on frozen ground, produced a discharge estimated at 2075 second-feet or 35.1 second-feet per square mile from the tributary drainage area of 59 square miles.

Mean monthly Run-off of Oneida Creek at Kenwood, Madison County, N. Y.

[Drainage area 59 square miles.]

MONTH.	SECOND-FEET.			SECOND-FEET PER SQUARE MILE.			INCHES ON DRAINAGE AREA.		
	1898.	1899.	1900.	1898.	1899.	1900.	1898.	1899.	1900.
January	......	117	92	......	1.98	1.56	......	2.28	1.80
February	......	93	......	......	1.58	......	......	1.64	......
March	......	157	148	......	2.66	2.51	......	3.06	2.89
April	......	183	198	......	3.10	3.35	......	3.46	3.74
May	......	62	......	......	1.06	......	......	1.21	......
June	......	30	21	......	0.51	0.35	......	0.57	0.39
July	......	25	38	......	0.42	0.64	......	0.48	0.74
August	......	......	19	......	......	0.32	......	......	0.37
September	......	......	16	......	......	0.27	......	......	0.30
October	83	23	19	1.40	0.39	0.32	1.61	0.45	0.37
November	106	33	91	1.78	0.56	1.54	1.98	0.62	1.72
December	90	60	127	1.53	1.02	2.15	1.75	1.17	2.47

The drainage area tributary to Oneida Creek above its mouth is 149 square miles.

Mean Daily Flow in Second-feet of Oneida Creek at Kenwood, N. Y.

[Drainage area 59 square miles.]

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1898.												
1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	90	70
2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....*	72	63
3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	70	80
4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	65	76*
5	.....	.....	.....	.....	.....	.....	.....	.....	.....	112	60	83
6	.....	.....	.....	.....	.....	.....	.....	.....	.....	58	58*	65
7	.....	.....	.....	.....	.....	.....	.....	.....	.....	60	60	60
8	.....	.....	.....	.....	.....	.....	.....	.....	.....	58	58	55
9	.....	.....	.....	.....	.....	.....	.....	.....	.....	45*	51	45
10	.....	.....	.....	.....	.....	.....	.....	.....	.....	23	265	50
11	.....	.....	.....	.....	.....	.....	.....	.....	.....	23	274	50*
12	.....	.....	.....	.....	.....	.....	.....	.....	.....	30	172	50
13	.....	.....	.....	.....	.....	.....	.....	.....	.....	27	140*	45
14	.....	.....	.....	.....	.....	.....	.....	.....	.....	51	119	50
15	.....	.....	.....	.....	.....	.....	.....	.....	.....	110	123	55
16	.....	.....	.....	.....	.....	.....	.....	.....	.....	100*	106	101
17	.....	.....	.....	.....	.....	.....	.....	.....	.....	102	106	108
18	.....	.....	.....	.....	.....	.....	.....	.....	.....	75	102	69*
19	.....	.....	.....	.....	.....	.....	.....	.....	.....	75	115	40
20	.....	.....	.....	.....	.....	.....	.....	.....	.....	75	121*	60
21	.....	.....	.....	.....	.....	.....	.....	.....	.....	70	123	205
22	.....	.....	.....	.....	.....	.....	.....	.....	.....	110	109	170
23	.....	.....	.....	.....	.....	.....	.....	.....	.....	100*	123	240
24	.....	.....	.....	.....	.....	.....	.....	.....	.....	100	100	173
25	.....	.....	.....	.....	.....	.....	.....	.....	.....	75	86	186*
26	.....	.....	.....	.....	.....	.....	.....	.....	.....	120	96	100
27	.....	.....	.....	.....	.....	.....	.....	.....	.....	130	77*	80
28	.....	.....	.....	.....	.....	.....	.....	.....	.....	129	61	50
29	.....	.....	.....	.....	.....	.....	.....	.....	.....	133	76	70
30	.....	.....	.....	.....	.....	.....	.....	.....	.....	100*	64	101
31	.....	.....	.....	.....	.....	.....	.....	.....	.....	100	.....	101
Mean	.....	.....	.....	.....	.....	.....	.....	.....	.....	83	105	90
1899.												
1	76*	50	115	123	71	46	18	.....	.....	15*	144	23
2	96	65	96	115*	69	36	20*	.....	.....	21	69	29
3	108	80	115	116	60	36	20	.....	.....	21	56	25*
4	210	73	112	96	59	35*	20	.....	.....	21	66	27
5	306	59*	157*	123	54	31	30	.....	.....	21	55*	29
6	160	50	122	131	55	31	34	.....	.....	21	44	29
7	143	50	203	166	48*	31	21	.....	.....	24	40	25
8	114*	50	163	334	53	24	41	.....	.....	18*	26	33
9	95	85	130	260*	53	24	40*	.....	.....	24	26	41
10	80	87	75	214	53	24	51	.....	.....	24	24	25*
11	133	100	90	196	54	25*	26	.....	.....	31	26	97
12	180	74*	149*	496	59	26	24	.....	.....	24	27*	70
13	205	56	235	416	59	26	24	.....	.....	24	28	70
14	273	37	157	406	48*	26	24	.....	.....	24	26	91
15	225*	47	128	341	53	51	21	.....	.....	19*	22	83
16	188	43	140	260*	60	41	20*	.....	.....	25	26	73
17	185	39	144	196	61	36	31	.....	.....	25	26	80*
18	101	41	133	166	63	30*	28	.....	.....	25	22	80
19	75	40*	157*	166	66	26	26	.....	.....	24	25*	97
20	65	52	198	144	91	31	26	.....	.....	24	23	79
21	67	160	135	136	80*	26	24	.....	.....	25	24	92
22	57*	365	157	110	82	26	25	.....	.....	25*	26	80
23	55	283	254	102*	63	31	25*	.....	.....	25	24	68
24	75	147	183	96	54	31	26	.....	.....	25	26	55*
25	85	99	190	91	66	31*	21	.....	.....	24	24	70
26	60	161*	170*	110	43	31	21	.....	.....	25	25*	86
27	55	283	157	110	43	31	20	.....	.....	24	26	39
28	42	123	128	91	71*	24	21	.....	.....	25	26	37
29	43*	.....	230	86	108	24	18	.....	.....	26*	26	34
30	51	.....	183	98*	76	21	20*	.....	.....	29	26	37
31	75	.....	165	.....	59	.....	21	.....	.....	31	.....	34*
Mean	117	93	157	183	63	30	25	.....	.....	23	33	60

*Sunday.

Mean Daily Flow in Second-feet of Oneida Creek at Kenwood, N. Y.—(Concluded).

*Sunday.

CHITTENANGO CREEK AT BRIDGEPORT, MADISON COUNTY, N. Y.

This creek rises in southwestern Madison county, flows in a northwesterly direction between Madison and Onondaga counties into Oneida Lake, the outlet of which is Oneida River, a tributary of Oswego River. The drainage basin of the stream is shown on Chittenango sheet of the United States Geological Survey. Observations for the computation of flow of this creek are made at the mill dam in Bridgeport, a short distance above its mouth. Gauge readings are taken three times a day, showing the height of the water above the crest of the dam, head on water wheels and widths of gate openings. The dam is of timber, backed with stone, and has a nearly level crest 215 feet in length, with flood gates at each end.

The current meter measurement was made at a highway bridge below the inflow of Butternut Creek, near Bridgeport, on June 16, 1900. The total flow of Chittenango Creek at that point was found to be 95 second-feet. The stage of the stream, as shown by the record kept at Bridgeport, was uniform for several days. The mean flow, as computed from the gauge readings,

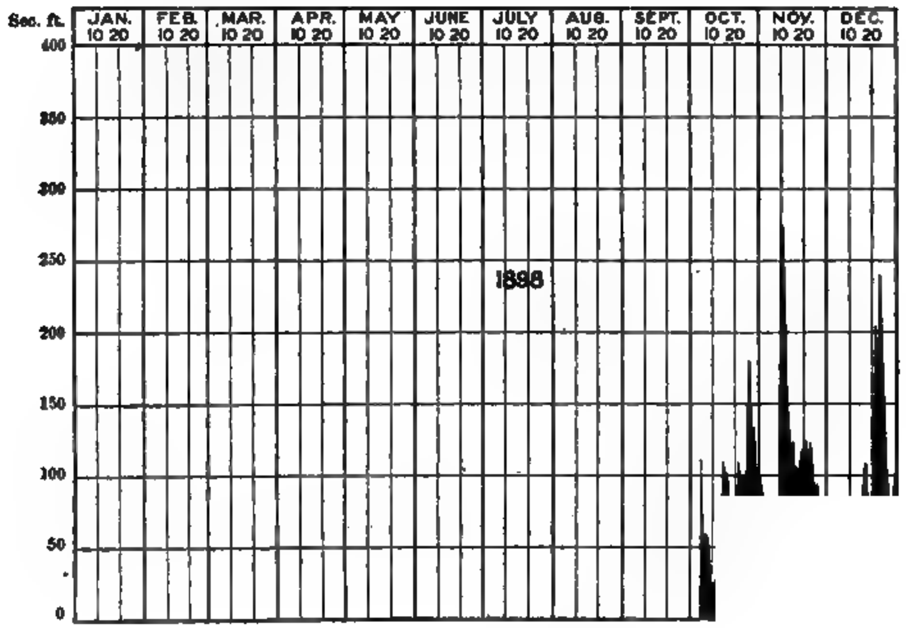

Fig. No. 13.—Discharge of Oneida Creek at Kenwood, Madison County, N. Y., 1898.

Fig. No. 14.—Discharge of Oneida Creek at Kenwood, Madison County, N. Y., 1899.

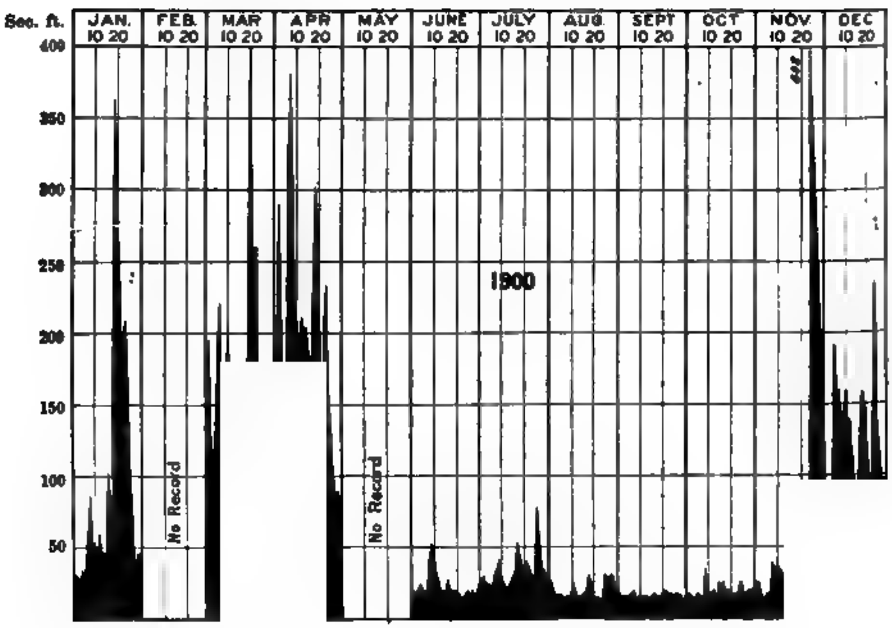

Fig. No. 15.—Discharge of Oneida Creek at Kenwood, Madison county, N. Y., 1900.

was 95 second-feet for June 15 and 16. There is no opportunity for separately measuring the discharge through the turbines, or leakage of the dam at this station, and an allowance of 15 second-feet for leakage of the dam, and of the dike leading to the old saw mill, has been made.

The saw mill, situated on the left side of the stream, runs very irregularly. The water wheels are old, and the penstocks leak badly. A current meter measurement was made in the head-race leading to the saw mill on June 16. The water wheels were running, and the flow was found to be 14.4 second-feet.

The relatively low run-off from the watershed of Chittenango Creek, during the summer months, as shown in the accompanying tables, may be attributed to diversion of a portion of the flow to supply the summit level of the Erie canal.

State dams are situated on the main stream at Chittenango, and on its two tributaries, Limestone Creek and Butternut Creek. Cazenovia Lake, Erieville, DeRuyter, and Jamesville reservoirs impound storage by which the flow is regulated to some extent.

The first two reservoirs are described in connection with the Chittenango meter station.[a]

De Ruyter reservoir, situated near Delphi, has a capacity of 504,468,000 cubic feet, and a water surface area of 626 acres. It receives storage from 18.5 square miles of area naturally tributary to Tioughnioga River, a tributary of Chenango River. The outflow from this reservoir is diverted into Limestone Creek and enters Erie canal through the Fayetteville feeder.

The Jamesville reservoir is situated on the headwaters of Butternut Creek which is tributary to Chittenango Creek through Limestone Creek. The reservoir has a storage capacity of 170,000,000 cubic feet, and a water surface area of 252 acres. It receives drainage from 46.2 square miles of watershed. The outflow is turned into Erie canal through the Orville feeder.

Owing to its location below three feeders of the canal, the records at Bridgeport do not show the actual run-off of the watershed during the canal season. During the winter some water, draining into the summit level of the canal, is drawn

[a] See page 384.

off into Chittenango Creek at the aqueducts crossing the main stream and its tributaries. Owing to uncertainty in the run-off of the watershed, derived from this record, the Bridgeport station was abandoned May 31, 1901, and a current meter station established, in its stead, above the State dam at Chittenango.

Mean Daily Flow in Second-feet, Chittenango Creek at Bridgeport, N. Y.

[Drainage area, 307 square miles.]

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1898.												
1	......	......	......	......	......	......	......	......	......	180	562	427
2	......	......	......	......	......	......	......	......	......	205*	559	380
3	......	......	......	......	......	......	......	......	......	171	434	348
4	......	......	......	......	......	......	......	......	......	172	358	395*
5	......	......	......	......	......	......	......	......	......	156	379	471
6	......	......	......	......	......	......	......	......	......	309	385*	414
7	......	......	......	......	......	......	......	......	......	235	331	404
8	......	......	......	......	......	......	......	......	......	204	359	320
9	......	......	......	......	......	......	......	......	......	130*	386	261
10	......	......	......	......	......	......	......	......	......	165	474	265
11	......	......	......	......	......	......	......	......	......	194	1,339	465*
12	......	......	......	......	......	......	......	......	......	196	1,571	434
13	......	......	......	......	......	......	......	......	......	197	1,265*	454
14	......	......	......	......	......	......	......	......	......	181	921	442
15	......	......	......	......	......	......	......	......	......	354	790	450
16	......	......	......	......	......	......	......	......	82	335*	694	472
17	......	......	......	......	......	......	......	......	116	299	615	619
18	......	......	......	......	......	......	......	......	58*	284	500	605*
19	......	......	......	......	......	......	......	......	119	297	506	678
20	......	......	......	......	......	......	......	......	139	320	675*	669
21	......	......	......	......	......	......	......	......	117	269	728	793
22	......	......	......	......	......	......	......	......	111	463	633	1,155
23	......	......	......	......	......	......	......	......	115	465*	598	1,293
24	......	......	......	......	......	......	......	......	135	487	569	1,401
25	......	......	......	......	......	......	......	......	85*	472	490	1,075*
26	......	......	......	......	......	......	......	......	142	352	442	857
27	......	......	......	......	......	......	......	......	149	367	465*	726
28	......	......	......	......	......	......	......	......	214	972	523	541
29	......	......	......	......	......	......	......	......	154	661	418	480
30	......	......	......	......	......	......	......	......	198	565*	421	680
31	......	......	......	......	......	......	......	......	......	519	......	680
Mean	......	......	......	......	......	......	......	......	129	344	612	597
1899.												
1	515*	520	632	337	447	426	116	84	81	75*	60	113
2	571	484	478	795*	357	346	55*	79	49	90	145	127
3	636	440	385	752	310	234	97	169	45*	91	145	143*
4	737	465	520	861	172	106*	118	126	138	90	160	139
5	1,067	385*	1,260*	866	172	184	132	184	81	80	165*	149
6	1,310	356	1,331	864	157	229	99	70*	76	141	228	151
7	1,282	342	1,475	857	95*	229	128	125	74	89	136	166
8	1,135*	465	1,069	1,420	172	244	132	125	96	45*	120	179
9	724	385	860	1,675*	172	192	45*	184	96	107	108	155
10	486	385	852	1,369	227	147	89	79	15*	117	65	168*
11	478	385	659	1,306	287	70*	262	62	71	101	46	181
12	623	385*	565*	1,274	172	169	271	44	96	101	35*	211
13	849	538	1,196	1,597	172	192	162	15*	92	85	72	236
14	738*	524	1,061	1,787	165*	182	169	141	56	72	57	396
15	1,260	462	970	1,614	180	109	99	125	88	15*	65	395
16	1,280	362	665	1,405*	174	184	70*	108	79	84	60	374
17	1,101	449	634	1,339	250	192	101	87	25*	80	88	[illegible]*
18	632	354	526	1,221	310	70*	221	76	89	88	67	[illegible]
19	390	385*	565*	859	374	152	210	91	74	88	25*	766
20	395	541	786	861	374	84	204	25*	96	45	83	[illegible]
21	389	444	766	629	385*	92	152	120	117	47	70	[illegible]
22	385*	619	962	447	281	100	117	109	89	15*	73	304
23	399	950	1,061	165*	265	124	70*	96	84	60	100	254
24	372	1,074	1,346	627	252	134	102	(a)	25*	68	102	300*
25	311	1,314	1,061	527	197	70*	102	......	67	43	110	139
26	362	1,015*	885*	456	195	141	122	......	49	57	25*	265
27	308	645	626	331	227	109	110	(*)	112	48	109	261
28	332	755	760	279	225*	109	88	......	119	25	133	201
29	355*	......	1,075	359	312	84	109	56	96	20*	114	249
30	448	......	1,360	295*	333	91	45*	96	79	65	105	244
31	637	......	1,360	......	229	......	141	112	......	65	......	240*
Mean	662	551	898	921	245	161	128	96	76	64	95	281

* Sundays.

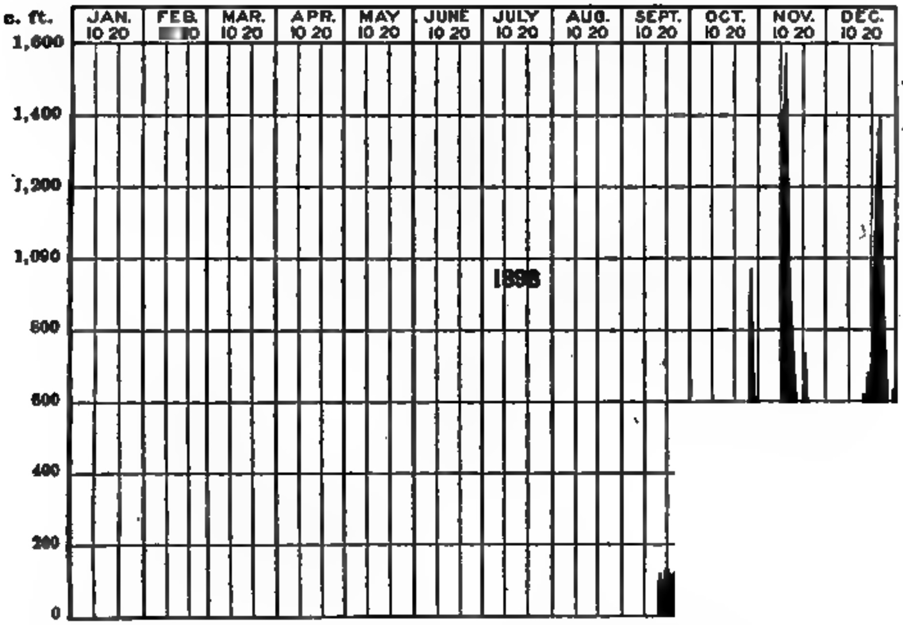

Fig. No. 16.—Discharge of Chittenango Creek at Bridgeport, Madison County, N. Y., 1898.

sec. ft.
1,600
1,400
1,200
1,000
800
600
400
200
0

Fig. No. 17.—Discharge of Chittenango Creek at Bridgeport, Madison County, N. Y., 1899.

Sec. ft.
1,600
1,400
1,200
1,000
800
600
400
200
0

Fig. No. 18.—Discharge of Chittenango Creek at Bridgeport, Madison County, N. Y., 1900.

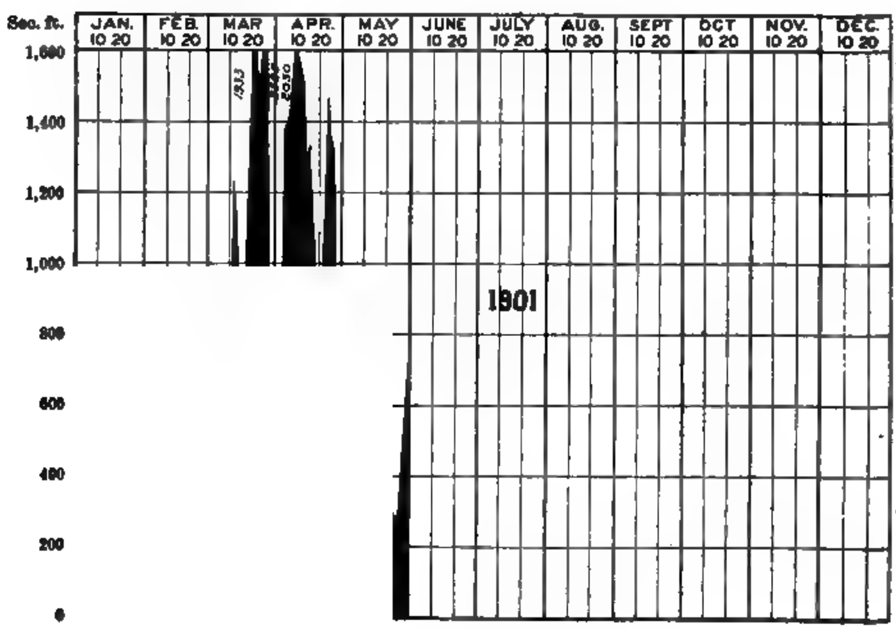

Fig. No. 19.—Discharge of Chittenango Creek at Bridgeport, Madison County, N. Y., 1901.

Mean Daily Flow in Second-feet, Chittenango Creek at Bridgeport, N. Y.—(Concluded).

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1900.												
1	161	467	774	1,230*	268	106	89*	107	91	67	108	608*
2	247	581	671	1,394	268	80	91	108	53*	108	100	355
3	242	581	605	1,447	245	70*	99	68	75	67	82	356
4	263	593*	595*	1,447	245	134	88	80	79	75	84*	288
5	318	580	792	1,342	287	125	82	88*	55	75	67	365
6	379	507	776	1,327	215*	132	158	108	67	91	70	1,330
7	275*	502	892	1,318	295	117	132	40	55	38*	73	1,150
8	374	1,437	591	1,365*	287	88	130*	40	33	100	105	1,086*
9	292	959	583	1,433	295	105	156	49	38*	102	130	690
10	307	1,313	511	1,255	245	70*	77	73	87	114	86	400
11	307	1,115*	425*	1,072	287	116	88	65	60	115	34*	330
12	302	771	463	858	318	108	63	37*	72	136	102	335
13	378	1,187	441	667	165*	67	66	38	87	72	87	480
14	275*	1,700	383	675	247	96	80	120	57	42*	106	456
15	378	1,445	367	595*	259	95	42*	89	65	98	98	452*
16	422	1,188	383	544	283	95	76	92	15*	94	106	425
17	504	985	376	667	268	70*	160	88	70	89	105	497
18	599	275*	355*	620	230	117	136	96	62	63	45*	588
19	971	187	608	1,703	237	73	101	53*	53	77	153	421
20	1,540	189	589	801	215*	107	136	63	111	57	169	423
21	1,485*	242	603	880	222	92	184	83	70	42*	136	431
22	1,445	987	788	785*	166	69	105*	66	117	86	139	358*
23	1,195	992	782	860	171	78	129	124	53*	58	111	378
24	1,074	1,005	1,008	770	186	48*	100	44	79	100	118	844
25	422	790*	1,118*	577	118	116	101	92	62	96	45*	1,231
26	429	706	788	436	98	81	252	38*	84	94	1,255	452
27	764	591	707	355	40*	73	172	75	99	75	1,958	606
28	790*	591	982	268	150	78	117	95	117	38*	1,835	618
29	522	....	1,090	275*	92	138	105*	86	108	75	1,272	442*
30	372	....	1,231	370	117	71	124	70	33*	90	1,105	275
31	372	....	1,351	....	90	....	133	66	....	85	....	347
Mean	561	725	697	911	207	93	110	73	63	81	327	562
1901.												
1	378	210	215	751	360	....	....	....	....	....	....	....
2	363	255	280	715	328	....	....	....	....	....	....	....
3	308	275*	275*	920	290	....	....	....	....	....	....	....
4	308	324	330	1,375	238	....	....	....	....	....	....	....
5	193	330	296	1,388	160*	....	....	....	....	....	....	....
6	160*	264	195.5	1,426	123	....	....	....	....	....	....	....
7	256	272	170	1,365*	148	....	....	....	....	....	....	....
8	306	310	150	1,538	160	....	....	....	....	....	....	....
9	307	330	210	2,030	158	....	....	....	....	....	....	....
10	320	355*	220*	1,825	228	....	....	....	....	....	....	....
11	407	322	510	1,531	335	....	....	....	....	....	....	....
12	592	275	807	1,510	275*	....	....	....	....	....	....	....
13	425*	250	1,262	1,350	425	....	....	....	....	....	....	....
14	434.5	182	1,144	1,245*	331	....	....	....	....	....	....	....
15	445.5	191	1,116	1,346	256	....	....	....	....	....	....	....
16	481.	208	1,006	1,200	346	....	....	....	....	....	....	....
17	592.5	220*	690*	1,198	222.5	....	....	....	....	....	....	....
18	514	285	912	953	286	....	....	....	....	....	....	....
19	418	229	1,077	838	275*	....	....	....	....	....	....	....
20	355*	195	1,297	838	291	....	....	....	....	....	....	....
21	512	212	1,476	905*	251	....	....	....	....	....	....	....
22	583	165	1,988	1,056	258	....	....	....	....	....	....	....
23	582	182	1,718	1,276	341	....	....	....	....	....	....	....
24	577	165*	1,485*	1,466	288	....	....	....	....	....	....	....
25	378	157	1,510	1,806	291	....	....	....	....	....	....	....
26	372	176	1,746	1,330	275*	....	....	....	....	....	....	....
27	355*	187	2,805	1,200	311	....	....	....	....	....	....	....
28	328	144	2,385	425*	376	....	....	....	....	....	....	....
29	342	....	1,028	440	556	....	....	....	....	....	....	....
30	298	....	767	483	688	....	....	....	....	....	....	....
31	302	....	595*	....	741	....	....	....	....	....	....	....
Mean	391	236	955	1,174	308	....	....	....	....	....	....	....

*Sundays.

Mean Monthly Run-off of Chittenango Creek, at Bridgeport, N. Y.

[Drainage area 307 square miles.]

MEAN MONTHLY FLOW IN SECOND-FEET.

MONTH.	1898.	1899.	1900.	1901.
January	....	662	561	391
February	....	551	725	236
March	....	893	697	955
April	....	921	911	1,174
May	....	245	207	308
June	....	161	98	....
July	....	128	110	....
August	....	96	78	....
September	129	76	68	....
October	344	64	81	....
November	612	95	327	....
December	597	281	562	....

SECOND-FEET PER SQUARE MILE.

MONTH.	1898.	1899.	1900.	1901.
January	....	2.15	1.80	1.27
February	....	1.80	2.36	0.77
March	....	2.90	2.27	3.12
April	....	3.00	2.97	3.83
May	....	0.80	0.67	1.00
June	....	0.53	0.30	....
July	....	0.40	0.36	....
August	....	0.31	0.24	....
September	0.42	0.25	0.22	....
October	1.12	0.20	0.26	....
November	2.00	0.30	1.07	....
December	1.94	0.91	1.83	....

INCHES ON DRAINAGE AREA.

MONTH.	1898.	1899.	1900.	1901.
January	....	2.49	2.07	1.46
February	....	1.87	2.45	0.80
March	....	3.34	2.61	3.59
April	....	3.34	3.31	4.28
May	....	0.92	0.77	1.15
June	....	0.58	0.33	....
July	....	0.46	0.40	....
August	....	0.35	0.27	....
September	0.47	0.28	0.24	....
October	1.29	0.23	0.30	....
November	2.24	0.34	1.20	....
December	2.23	1.05	2.10	....

CHITTENANGO CREEK AT CHITTENANGO, MADISON COUNTY, N. Y.

A current meter gauging station was established at Main street highway bridge in Chittenango village, May 22, 1901. The stream at this point is entrained between parallel walls, affording a channel 50 feet wide, over which the bridge passes in a single span. The bridge stands at an angle of 60° to the

thread of the stream, and has a span between abutments of 57 feet. The gauge board is secured in a vertical position to the right abutment on the upstream side, and reads decimally from zero to 8 feet. The stage of the stream is observed twice daily by the gauge reader, Frank A. Sutter. The bench mark is on the upstream corner of the coping of the right-hand bridge abutment.

Elevation bench mark 100.00
Elevation gauge zero 91.77

Current Meter Discharge Measurements of Chittenango Creek at Chittenango, N. Y.

DATE.	Gauge height, feet.	Discharge, second-feet.	Hydrographer.
1901.			
August [illegible]	1.78	45	R. E. Horton.
August [illegible]	1.78	48	R. E. Horton.
July 15	1.80	58	E. C. Murphy.
May 22	2.08	102	R. E. Horton.
June 5	2.3	188	J. D. Luther.
May 31	2.59	253	J. D. Luther.

The location of the Chittenango station is shown on the Chittenango quadrangle of the Topographic atlas of the Geological Survey. The gauging station is one-half mile above the State dam diverting water for the supply of the summit level of the Erie canal. The records kept show the amount of water supply available for canal purposes. The gauging station at Bridgeport[a] is located below this feeder. The records for the two stations are not comparable during the season of canal navigation.

The flow of Chittenango Creek is regulated by storage in Cazenovia Lake and Erieville reservoir.[b]

Erieville Reservoir.

Tributary watershed .... 5.4 square miles.
Storage capacity .... 318,424,000 cubic feet.
Water surface .... 340 acres.

[a] Described on page 390.

[b] Report on New York State Barge Canal survey, p. [illegible].

Cazenovia Lake.

Tributary watershed ....8.7 square mil
Storage capacity ....206,997,000 cubic feet.
Water surface ....1.7 square mile

From Chittenango Falls to Chittenango village, a distance five miles, the stream falls from elevation 860 feet above ti to elevation 420. From the foot of Chittenango Falls to Chi tenango village, the stream flows through a deep, narro valley where several water powers have at one time been i use, now mostly abandoned.

The accompanying table shows the mean daily stage of th stream.

A freshet December 15, 1901, raised the water to elevatio 7.0 feet on the gauge board.

Drainage Areas Tributary to Chittenango Creek.

LOCATION.	Square miles.
Chittenango gauging station	a [illegible]
Bridgeport gauging station	[illegible]
Mouth of stream	[illegible]

Daily Gauge Height of Chittenango Creek at Chittenango, N. Y.

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1	......	......	......	......	......	2.6	1.9	1.75	1.95	1.77½	1.80	1.92½
2	......	......	......	......	......	2.8	1.9	1.75	1.95	1.77½	1.80	2.02½
3	......	......	......	......	......	2.47½	1.85	1.8	1.85	1.77½	1.80	2.4
4	......	......	......	......	......	2.35	1.85	1.8	1.77½	1.77½	1.82½	1.8
5	......	......	......	......	......	2.3	2.0	1.8	1.8	1.77½	1.85	1.85
6	......	......	......	......	......	2.22½	2.1	1.82½	1.8	1.77½	1.82½	1.85
7	......	......	......	......	......	2.85	2.05	1.9	1.72½	1.75	1.85	1.85
8	......	......	......	......	......	2.62½	1.9	1.87½	1.7	1.77½	1.85	1.95
9	......	......	......	......	......	2.45	1.9	1.82½	1.7	1.77½	1.87½	2.35
10	......	......	......	......	......	2.25	1.9	1.85	1.8	1.77½	1.87½	2.4
11	......	......	......	......	......	2.15	1.9	1.75	1.7	1.77½	1.8	2.27½
12	......	......	......	......	......	2.17½	1.9	1.9	1.77½	1.77½	2.05	2.22½
13	......	......	......	......	......	2.1	1.8	1.9	1.85	1.77½	2.0	2.22½
14	......	......	......	......	......	2.05	1.8	1.9	1.77½	1.77½	1.8	2.67½
15	......	......	......	......	......	2.0	1.75	1.9	1.75	1.77½	1.8	4.65
16	......	......	......	......	......	2.0	1.8	1.85	1.75	1.77½	2.0	3.5
17	......	......	......	......	......	2.0	1.85	1.87½	1.8	1.77½	1.8	3.4
18	......	......	......	......	......	1.95	1.8	1.8	1.77½	1.8	1.8	3.3
19	......	......	......	......	......	1.95	1.8	1.85	1.82½	1.82½	1.8	3.0
20	......	......	......	......	......	2.72½	1.8	1.9	1.77½	1.8	1.8	2.45
21	......	......	......	......	......	2.97½	1.8	1.9	1.82½	1.77½	1.8	2.4
22	......	......	......	......	2.0	2.5	1.8	1.9	1.77½	1.77½	1.8	2.05
23	......	......	......	......	2.42½	2.85	1.8	1.9	1.77½	1.82½	1.8	2.0
24	......	......	......	......	2.15	2.4	1.8	1.92½	1.77½	1.85	1.87½	2.0
25	......	......	......	......	2.1	2.2	1.82½	1.8	1.77½	1.85	2.07½	2.0
26	......	......	......	......	2.12½	2.2	1.80	1.85	1.77½	1.85	1.95	2.0
27	......	......	......	......	2.1	2.1	1.75	1.85	1.75	1.85	1.87½	2.0
28	......	......	......	......	2.25	2.0	1.7	1.85	1.75	1.82½	2.0	2.0
29	......	......	......	......	2.47½	2.0	1.7	1.85	1.75	1.82½	1.9	2.2
30	......	......	......	......	2.65	1.9	1.87½	1.87½	1.77½	1.80	1.9	2.2
31	......	......	......	......	2.6	......	1.82½	1.9	......	1.80	......	2.1

a Including Chenango River area made tributary to feed Erieville reservoir.

Fig. No. 20.—Chittenango Creek: Chittenango Falls below Cazenovia, Madison County.

Principal Water Powers on Chittenango Creek.

No. of dam.	LOCATION.	Available head. Feet.	Description.
1	Bridgeport	6	Snyder Bros'. grist mill, wheels rated 115 H. P.
1	Bridgeport	6 to 8	Snyder Bros'. saw mill, wheels rated about 20 H. P.
2	Chittenango	5	State canal feeder dam.
3	Chittenango	8	Walrath's dam, abandoned iron works.
4	Chittenango	14	Chittenango roller mills, rated 57 H. P.
4	Chittenango	14	Chittenango cotton mill, abandoned, owns one-half power at dam.
5	Chittenango	8	Abandoned distillery.
6	Chittenango Springs	6 to 8	Nesbet's saw mill.
7	Above Chittenango Springs	6 to 8	Marl lime and saw mill.
8	Chittenango Falls	120	Undeveloped.
9	Chittenango Falls	10 to 12	Abandoned repair shop.
10	Cazenovia	10	Bentley's dam, grist mill.

GAUGINGS OF SKANEATELES LAKE OUTLET.

Skaneateles Lake is fifth in size of the Finger Lakes tributary to Seneca River. Its run-off is of special interest as illustrating the effect of lake storage on the regimen of flow of that stream. The lake lies in a deep, narrow valley conducive to rapid run-off, so that the water level of the lake fluctuates frequently. Owing to extensive lake storage, the variations in the outflow are very moderate. The lake and its watershed are shown on the Skaneateles Quadrangle of the Topographic Survey of the State. The watershed areas are as follows:

Land surface above State dam at Skaneateles	60.25	square miles.
Water surface of lake at Skaneateles	12.75	square miles.
Total drainage area above foot of lake	73	square miles.
Total area above Willow Glen weir	74.25	square miles.
Total area above Erie canal at Jordan	93	square miles.

The elevation of Skaneateles Lake is 867 feet above mean tide, and that of the outlet at Erie canal crossing, near Jordan, about 400 feet. The intervening fall of 467 feet is largely taken up by water powers situated at seventeen dams on the outlet in the intervening length of 12 miles. The power is chiefly used for paper, woolen, flour, and furniture manufacturing.

The dam at the foot of the lake was originally constructed by the State of New York in 1844. In 1893 the masonry dam at the foot of the lake was rebuilt by the Syracuse Water Board. and since July 1, 1894, the lake has been used as the storage reservoir for the municipal supply of the city of Syracuse, the water being taken a distance of 19¼ miles through a 30-inch cast-iron conduit.

A record of the elevation of water in Skaneateles Lake reservoir has been kept each week since January 1, 1878, by gate keepers of New York State canals. The results of this record may be found in the annual report of the Superintendent of Public Works on canals, for 1899, pages 156-159.

In connection with condemnation proceedings for the acquisition of water rights on Skaneateles outlet by the city of Syracuse, a number of gaugings of the outflow from the lake were made; some of the results of which have been reduced to second-feet and are given below.[a]

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[a] Abstracted from proceedings and evidence before Commissioners of Appraisal, Supreme Court, Appellate Division, Fourth Department, City of Syracuse, vs. Richard M. Stacey, et al., Vols I-X inclusive.

Mean Daily Flow in Second-feet at Skaneateles Lake at State Dam, Skaneateles, N. Y.

[Drainage area 73 square miles.]

The records included are as follows:

At State dam, at foot of lake, October 26, 1890, to July 31, 1891.

At Stott's farm weir, August 16, 1892, to September 19, 1893.

At Stott's farm weir, June 6, 1894, to December 2, 1894.

At Jordan, September 26, 1890, to October 28, 1891.

At Jordan, August 16, 1892, to November 30, 1892.

At Old Willow Glen weir, March 10, to July 13, 1895.

At New Willow Glen weir, July 14, 1895, to date.

The first table shows the estimated discharge through the dam at the foot of the lake for the period from September 26, 1890, to February 27, 1892, inclusive. At the time these measurements were made, the dam had a spillway 48 feet in length, with a flat and nearly horizontal crest 4.5 feet in width. The crest was obstructed by supports for a foot bridge by which the overflow was divided into a number of shorter sections. There were also six rectangular gateways through the dam, having their sills at a uniform elevation of 9.33 feet below the crest line. Four gateways were 4 feet wide and two were 3.5 feet in width. Sliding wooden sluice gates were used, which were capable of being raised 4 or 5 feet. No allowance for leakage has been made, and the results are considered as somewhat roughly approximate.

The second series of tables shows the results of measurements of discharge of Skaneateles Lake at the Stott's Farm wier, situated 6,000 feet north of the foot of the lake and recovering drainage from 1.25 square miles tributary to the outlet, in addition to the drainage area of the lake itself. The weir had a clear crest 30 feet in length and ⅛ inch in breadth. The flow has been computed by means of the Francis formula for a sharp crested weir. The crest was somewhat irregular, and the resulting calculated discharge is considered as roughly approximate only.

Mean Daily Flow in Second-feet Skaneateles Outlet at Stott's Weir, Willow Glen, N. Y.

(Drainage area 74 square miles.)

Mean Daily Flow in Second-feet, Skaneateles Outlet, Stott's Weir, Willow Glen, N. Y.—(Concluded.)

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1894.												
1	......	......	......	......	......	......	......	54.0	87.5	78.0	81.0	72.2
2	......	......	......	......	......	......	15.4	56.4	66.8	78.0	78.0	75.0
3	......	......	......	......	......	......	19.	59.0	66.8	78.0	84.0	......
4	......	......	......	......	......	......	17.2	59.0	65.5	81.0	84.0	......
5	......	......	......	......	......	......	15.4	54.0	66.8	81.0	84.0	......
6	......	......	......	......	......	7.5	15.4	56.0	81.0	81.0	84.0	......
7	......	......	......	......	......	5.7	17.2	56.0	102.0	78.0	84.0	......
8	......	......	......	......	......	4.5	......	54.0	102.0	78.0	84.0	......
9	......	......	......	......	......	4.0	39.7	59.0	105.0	81.0	81.0	......
10	......	......	......	......	......	......	42.0	54.0	81.0	87.0	81.0	......
11	......	......	......	......	......	8.5	35.2	56.0	78.0	87.0	78.0	......
12	......	......	......	......	......	4.0	31.0	54.0	78.0	84.0	78.0	......
13	......	......	......	......	......	4.5	29.0	54.0	81.0	87.0	78.0	......
14	......	......	......	......	......	3.5	31.0	56.0	84.0	84.0	78.0	......
15	......	......	......	......	......	3.5	......	56.0	81.0	87.0	78.0	......
16	......	......	......	......	......	3.5	27.0	54.0	81.0	87.0	78.0	......
17	......	......	......	......	......	......	25.0	54.0	81.0	87.0	81.0	......
18	......	......	......	......	......	2.5	25.0	56.0	84.0	81.0	81.0	......
19	......	......	......	......	......	10.0	23.0	64.2	86.8	81.0	78.0	......
20	......	......	......	......	......	2.	23.0	61.6	86.8	81.0	78.0	......
21	......	......	......	......	......	28.0	27.0	59.0	86.8	81.0	78.0	......
22	......	......	......	......	......	11.0	......	56.0	84.0	78.0	78.0	......
23	......	......	......	......	......	2.6	27.0	54.0	81.0	81.0	78.0	......
24	......	......	......	......	......	......	31.0	61.6	78.0	84.0	78.0	......
25	......	......	......	......	......	6.8	37.6	64.2	78.0	84.0	78.0	......
26	......	......	......	......	......	21.0	72.2	61.6	78.0	81.0	78.0	......
27	......	......	......	......	......	17.2	69.7	64.2	78.0	75.2	78.0	......
28	......	......	......	......	......	27.0	59.0	61.6	75.1	75.2	75.2	......
29	......	......	......	......	......	29.0	......	61.6	72.2	75.2	75.2	......
30	......	......	......	......	......	25.0	56.6	59.0	72.2	75.2	75.2	......
31	......	......	......	......	......	......	54.0	56.4	......	78.0	......	......
Mean	......	......	......	......	......	10.1	33.2	56.0	79.3	81.2	79.4	[illegible]

In order to determine the run-off to the watershed contributed by the drainage area of the outlet itself, from the foot of the lake to Jordan, the following series of gaugings were made, covering the period from September 26, 1890, to November 30, 1892. The drainage area of 93 square miles at Jordan includes 73 square miles, the run-off from which is subject to lake storage, and 20 square miles which drains directly into the outlet. The measurements at Jordan were made by means of tube floats, by timing the interval required for their passage through a section of the stream channel 100 feet in length.

Mean Daily Flow in Second-feet Skaneateles Outlet, Jordan, N. Y.

[Drainage area, 93 square miles.]

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1890.												
1	......	......	......	......	......	......	......	......	......	154.2	146.3	162.7
2	......	......	......	......	......	......	......	......	......	159.6	116.1	175.2
3	......	......	......	......	......	......	......	......	......	144.5	159.6	167.4
4	......	......	......	......	......	......	......	......	......	147.4	152.7	152.5
5	......	......	......	......	......	......	......	......	......	143.7	146.8	167.4
6	......	......	......	......	......	......	......	......	......	158.1	142.9	168.9
7	......	......	......	......	......	......	......	......	......	159.6	138.5	......
8	......	......	......	......	......	......	......	......	......	155.0	147.8	128.4
9	......	......	......	......	......	......	......	......	......	164.3	151.4	178.8
10	......	......	......	......	......	......	......	......	......	150.9	158.1	158.1
11	......	......	......	......	......	......	......	......	......	155.0	148.5	148.9
12	......	......	......	......	......	......	......	......	......	146.6	161.3	149.2
13	......	......	......	......	......	......	......	......	......	151.6	158.1	161.2
14	......	......	......	......	......	......	......	......	......	156.5	161.3	159.6
15	......	......	......	......	......	......	......	......	......	137.5	171.0	176.7
16	......	......	......	......	......	......	......	......	......	137.9	156.5	181.4
17	......	......	......	......	......	......	......	......	......	149.7	152.2	......
18	......	......	......	......	......	......	......	......	......	141.1	......	161.2
19	......	......	......	......	......	......	......	......	......	168.9	161.2	141.7
20	......	......	......	......	......	......	......	......	......	164.3	179.8	......
21	......	......	......	......	......	......	......	......	......	165.8	168.9	......
22	......	......	......	......	......	......	......	......	......	158.6	158.1	179.8
23	......	......	......	......	......	......	......	......	......	151.7	138.1	165.8
24	......	......	......	......	......	......	......	......	......	209.3	......	147.8
25	......	......	......	......	......	......	......	......	......	179.8	175.2	......
26	......	......	......	......	......	......	......	......	170.5	128.2	173.6	......
27	......	......	......	......	......	......	......	......	162.8	147.1	162.7	......
28	......	......	......	......	......	......	......	......	154.5	158.7	156.5	......
29	......	......	......	......	......	......	......	......	150.0	158.1	158.1	......
30	......	......	......	......	......	......	......	......	145.2	135.2	161.2	......
31	......	......	......	......	......	......	......	......	......	155.0	......	......
Mean	......	......	......	......	......	......	......	......	156.6	153.9	155.2	161.5
1891.												
1	......	......	......	......	......	......	......	139.1	......	......	......	......
2	......	......	......	......	......	......	139.2	154.5	......	......	......	......
3	......	......	......	......	......	......	91.9	153.7	......	......	......	......
4	......	......	......	......	......	......	106.6	128.7	139.5	......	......	......
5	......	......	......	......	......	......	108.9	144.8	141.8	143.2	......	......
6	......	......	......	......	......	......	114.7	150.4	......	......	......	......
7	......	......	......	......	......	......	106.5	132.9	139.2	154.8	......	......
8	......	......	......	......	......	......	111.1	132.9	......	156.5	......	......
9	......	......	......	......	......	......	120.4	......	143.1	153.7	......	......
10	......	......	......	......	......	......	74.8	......	......	150.5	......	......
11	......	......	......	......	......	129.1	118.8	168.9	151.8	139.6	......	......
12	......	......	......	......	......	127.8	......	172.1	162.7	145.8	......	......
13	......	......	......	......	......	121.2	118.3	172.0	150.4	146.0	......	......
14	......	......	......	......	......	119.5	117.0	164.3	153.1	......	......	......
15	......	......	......	......	......	126.0	130.8	158.1	153.8	......	......	......
16	......	......	......	......	......	125.2	122.8	152.7	149.6	139.9	......	......
17	......	......	......	......	......	119.6	120.7	159.6	151.4	143.4	......	......
18	......	......	......	......	......	119.5	110.1	165.8	149.8	......	......	......
19	......	......	......	......	......	130.2	128.7	156.5	141.5	154.1	......	......
20	......	......	......	......	......	130.8	126.5	158.1	140.1	156.5	......	......
21	......	......	......	......	......	130.0	121.9	138.8	148.0	164.3	......	......
22	......	......	......	......	......	143.9	112.2	144.6	139.8	155.0	......	......
23	......	......	......	......	......	133.5	97.0	159.6	146.2	152.2	......	......
24	......	......	......	......	......	132.2	102.6	146.2	141.1	149.8	......	......
25	......	......	......	......	......	130.9	98.4	132.1	141.5	135.6	......	......
26	......	......	......	......	......	128.3	......	128.2	151.4	......	......	......
27	......	......	......	......	......	134.5	100.6	123.2	......	139.8	......	......
28	......	......	......	......	......	116.8	113.2	......	......	140.3	......	......
29	......	......	......	......	......	119.5	......	128.4	......	......	......	......
30	......	......	......	......	......	137.3	......	......	......	......	......	......
31	......	......	......	......	......	......	137.5	118.1	......	......	......	......
Mean	......	......	......	......	......	127.8	115.3	153.1	146.6	143.7	......	......

Mean Daily Flow in Second-feet, Skaneateles Outlet, Jordan, N. Y.—(Concluded.)

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1892.												
1	......	......	......	......	......	......	......	......	108.6	117.8	......	......
2	......	......	......	......	......	......	......	......	98.9	......	......	......
3	......	......	......	......	......	......	......	......	105.7	119.6	117.3	......
4	......	......	......	......	......	......	......	......	......	128.8	118.3	......
5	......	......	......	......	......	......	......	......	110.4	150.8	115.8	......
6	......	......	......	......	......	......	......	......	......	132.5	......	......
7	......	......	......	......	......	......	......	......	......	124.3	113.9	......
8	......	......	......	......	......	......	......	......	......	121.6	......	......
9	......	......	......	......	......	......	......	......	128.7	......	......	......
10	......	......	......	......	......	......	......	......	108.4	119.6	108.6	......
11	......	......	......	......	......	......	......	......	......	111.9	......	......
12	......	......	......	......	......	......	......	......	111.1	......	109.7	......
13	......	......	......	......	......	......	......	......	105.8	118.8	......	......
14	......	......	......	......	......	......	......	......	......	117.9	112.2	......
15	......	......	......	......	......	......	......	......	......	116.1	101.7	......
16	......	......	......	......	......	......	......	122.5	115.6	......	......	......
17	......	......	......	......	......	......	......	119.5	122.1	119.2	109.4	......
18	......	......	......	......	......	......	......	118.3	......	115.8	114.3	......
19	......	......	......	......	......	......	......	113.8	124.5	110.9	136.5	......
20	......	......	......	......	......	......	......	123.1	122.5	118.5	......	......
21	......	......	......	......	......	......	......	......	117.5	......	126.9	......
22	......	......	......	......	......	......	......	144.5	......	......	119.9	......
23	......	......	......	......	......	......	......	184.2	117.2	......	109.4	......
24	......	......	......	......	......	......	......	145.1	126.5	......	113.7	......
25	......	......	......	......	......	......	......	170.5	......	......	114.5	......
26	......	......	......	......	......	......	......	143.8	140.9	......	107.8	......
27	......	......	......	......	......	......	......	122.3	129.4	......	......	......
28	......	......	......	......	......	......	......	......	128.5	......	119.9	......
29	......	......	......	......	......	......	......	117.8	110.5	......	113.9	......
30	......	......	......	......	......	......	......	112.1	113.5	......	108.9	......
31	......	......	......	......	......	......	......	114.3	......	......	......	......
Mean	......	......	......	......	......	......	......	128.5	116.5	121.2	114.6	......

Beginning March 6, 1895, a daily record of the depth of water, flowing over a standard sharp crested gauging weir, has been kept by the water department of Syracuse. The weir is located at Willow Glen, one and one-half miles below the foot of the lake. It has complete contractions at the ends; the length of crest being as follows:

March 6, to July 13, 1895, inclusive......... 29.5 feet.
July 14, 1895, to date...................... 27.0 feet.

The discharge over this weir has been calculated by means of the Francis formula, with proper allowances for end contractions and velocity of approach. Four current meter measurements of the discharge of Skaneateles outlet were made during the present season.

Measurements of Skaneateles Outlet at Willow Glen, N. Y.

DATE.	Depth on weir, inches.	Calculated flow over weir, second-feet.	DISCHARGED BY CURRENT METER.	
			Second-feet.	Per cent. of weir discharge.
July 20, 1901 *b*	13.75	113.0	117.8	104.2
August 29, 1901 *c*	11.97	90.8	92	101.3
August 29, 1901 *c*	12.02	91.2	88	96.5
August 29, 1901 *c*	12.02	91.2	92	[illegible]

b R. E. Horton, Hydrographer.
c E. C. Murphy, Hydrographer.

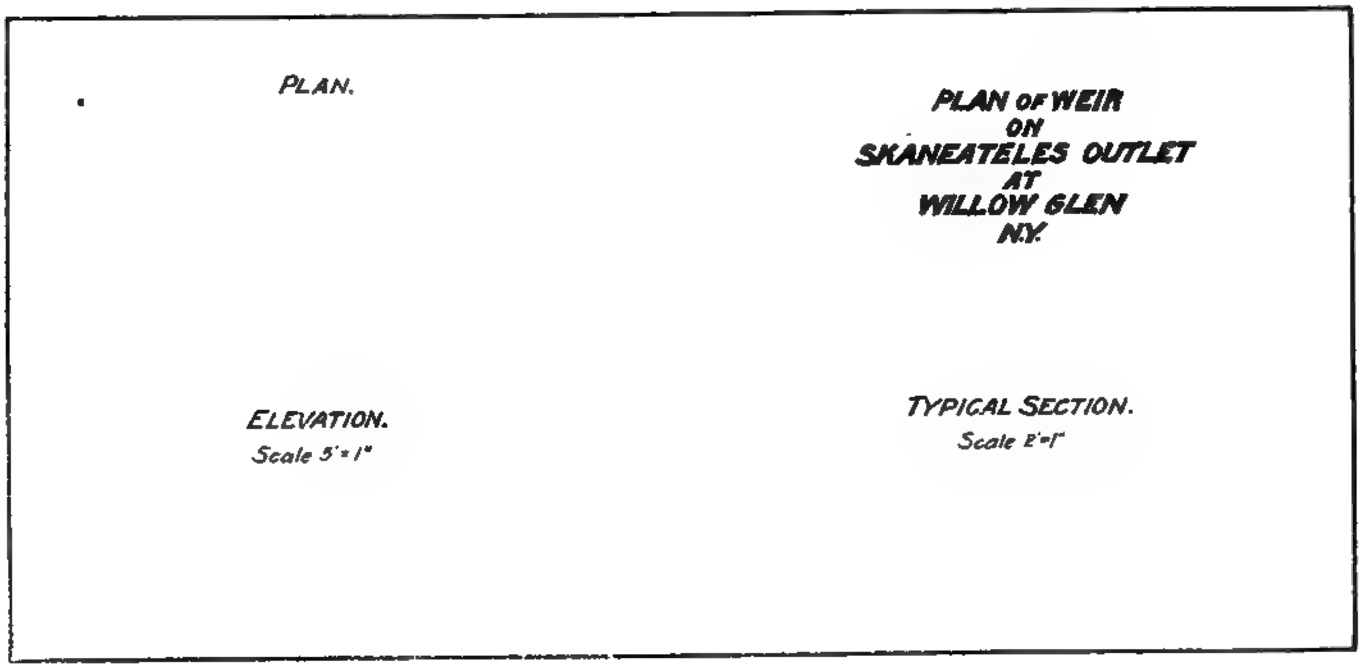
PLAN.
PLAN OF WEIR
ON
SKANEATELES OUTLET
AT
WILLOW GLEN
N.Y.
ELEVATION.
Scale 5' = 1"
TYPICAL SECTION.
Scale 2' = 1"

Fig. No. 21.

The crest is level and the depth of overflow is measured from a stake 5.2 feet upstream from the weir. The channel above is straight and has an average depth of about 1.5 feet below the weir crest. The velocity of approach varies from zero to two feet per second. As stated above, water has been diverted from Skaneateles Lake, beginning July 1, 1894.

The following tables represent the mean daily flow in the outlet, not including diversion. The table represents the actual volume of water flowing down the outlet channel. To obtain the total run-off from the watershed, the amount of diversion for municipal supply should be added. This has been done in the following summary, showing the actual run-off in inches on the watershed deduced from all the available records. The flow in the conduit leading from Skaneateles dam to Syracuse is determined by measuring the effective head and area of discharge in the gatehouse at Skaneateles village. The gates are four in number. They are 2.5 feet wide and 4.5 feet high. The flow is regulated by gate No. 3, and the discharge is calculated for each day from the formula for orifices. The coefficient used is stated to be 0.62.

The recorded depths on Willow Glen weir, together with the estimated monthly water consumption by the city of Syracuse, have been furnished by John H. Moffit, Superintendent, Syracuse Water Department.

Mean Monthly Run-off of Skaneateles Outlet at Stott's Weir, Willow Glen, N. Y.

[Drainage area 74 square miles.]

MONTH.	SECOND-FEET.			SECOND-FEET PER SQUARE MILE.			INCHES ON DRAINAGE AREA.		
	1892.	1893.	1894.	1892.	1893.	1894.	1892.	1893.	1894.
January	......	68.0	......	......	.92	......	......	1.06	......
February	......	74.7	......	......	1.01	......	......	1.05	......
March	......	80.2	......	......	1.08	......	......	1.24	......
April	......	98.1	......	......	1.36	......	......	1.41	......
May	......	222.7	......	......	3.01	......	......	3.46	......
June	......	158.1	10.1	......	2.13	.14	......	2.39	.16
July	......	157.3	33.2	......	2.12	.45	......	2.44	.52
August	109.7	......	56.0	1.46	......	.76	1.68	......	.87
September	101.9	117.5	79.3	1.38	1.59	1.07	1.55	1.78	1.19
October	97.7	......	81.2	1.32	......	1.09	1.52	......	1.25
November	85.2	......	79.4	1.15	......	1.07	1.29	......	1.19
December	82.1	......	75.1	1.11	......	1.01	1.28	......	1.16

Mean Daily Flow in Second-feet, Skaneateles Outlet at Willow Glen Weir.

[Drainage area, 74 square miles.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1895.												
1	......	......	......	192.4	112.3	85.4	77.0	100.3	100.3	95.7	100.3	94.2
2	......	......	......	173.4	139.7	95.4	82.6	97.2	100.3	97.2	97.2	97.2
3	......	......	......	178.4	160.7	85.4	82.6	97.2	100.3	95.7	97.2	97.2
4	......	......	......	163.4	156.6	95.4	82.6	97.2	100.3	95.7	97.2	97.2
5	......	......	......	173.4	160.2	95.4	85.4	100.3	100.3	95.7	97.2	94.2
6	......	......	......	193.4	156.6	91.4	85.4	100.3	97.2	95.7	97.2	85.5
7	......	......	......	196.5	150.0	85.4	85.4	100.3	97.2	95.7	97.2	91.0
8	......	......	......	173.4	150.0	85.4	85.4	100.3	100.3	95.7	100.3	87.4
9	......	......	......	160.5	139.5	85.4	85.4	100.3	97.2	97.2	106.6	87.4
10	......	......	2.8	136.9	109.5	85.4	85.4	100.3	96.2	95.7	100.3	90.0
11	......	......	43.7	149.5	100.8	85.4	85.4	98.5	97.2	95.7	100.3	[illegible]
12	......	......	66.0	196.0	112.9	85.4	85.4	100.3	97.2	97.2	100.3	[illegible]
13	......	......	91.4	166.0	112.3	85.4	84.4	100.3	97.2	100.3	94.2	[illegible]
14	......	......	91.4	156.0	122.4	85.4	87.4	97.2	95.7	97.2	94.2	[illegible]
15	......	......	85.4	171.0	125.0	85.4	88.3	97.2	95.7	97.2	94.2	[illegible]
16	......	......	91.4	171.0	122.4	85.4	88.3	97.2	95.7	95.7	94.2	[illegible]
17	......	......	91.4	167.4	122.4	85.4	88.3	97.2	95.7	97.2	94.2	[illegible]
18	......	......	88.4	167.4	122.4	85.4	88.3	97.2	95.7	100.3	94.2	[illegible]
19	......	......	97.4	164.0	97.6	85.4	91.2	95.7	95.7	100.3	94.2	[illegible]
20	......	......	100.2	164.0	91.4	82.6	94.2	95.7	100.3	100.3	97.2	[illegible]
21	......	......	100.2	164.0	85.4	82.6	94.2	95.7	95.7	100.3	97.2	[illegible]
22	......	......	97.6	167.4	85.4	85.4	94.2	97.2	95.7	100.3	97.2	82.8
23	......	......	97.6	167.4	85.4	85.4	94.2	97.2	95.7	100.3	97.2	82.8
24	......	......	97.6	164.0	85.4	82.6	94.2	97.2	95.7	100.3	100.3	82.8
25	......	......	100.2	164.0	85.4	79.8	94.2	97.2	95.7	106.6	100.3	82.8
26	......	......	100.2	164.0	85.4	79.8	94.2	95.7	95.7	106.6	100.3	82.9
27	......	......	94.5	136.0	103.4	79.5	94.2	95.7	95.7	106.6	97.2	85.5
28	......	......	94.5	122.4	85.4	79.8	100.3	95.7	95.7	106.6	94.2	85.5
29	......	......	97.6	119.2	91.4	79.8	103.3	97.2	97.2	106.6	94.2	85.5
30	......	......	94.5	116.0	85.4	77.0	103.4	97.2	97.2	100.3	94.2	82.8
31	......	......	100.4	......	85.4	......	100.3	97.2	......	100.3	......	82.8
Mean	......	......	87.2	145.7	110.7	84.0	90.7	97.8	97.2	99.2	97.2	84.1
1896.												
1	82.6	80.0	91.2	108.4	100.8	78.7	77.3	77.3	82.8	85.5	77.3	73.4
2	80.0	80.0	91.2	91.2	100.8	78.7	77.3	78.7	82.8	85.5	77.3	73.4
3	80.0	80.0	82.8	82.8	91.2	78.7	77.3	78.7	82.8	85.5	77.3	73.4
4	80.0	80.0	82.8	82.8	85.5	78.7	77.3	78.7	82.8	77.3	77.3	73.4
5	80.0	80.0	82.8	85.5	85.5	78.7	77.3	78.7	82.8	77.3	77.3	69.6
6	80.0	82.8	82.8	82.8	85.5	78.7	77.3	78.7	82.8	77.3	77.3	[illegible]
7	80.0	82.8	100.8	82.8	91.2	80.8	77.3	78.7	82.8	77.3	76.0	[illegible]
8	80.0	82.8	91.2	82.8	91.2	80.8	77.3	78.7	82.8	84.1	76.0	74.7
9	80.0	85.5	82.8	80.0	91.2	80.8	77.3	78.7	82.8	86.9	76.0	74.7
10	78.7	82.8	82.8	80.0	86.9	88.3	77.3	78.7	82.8	77.3	76.0	73.2
11	78.7	80.0	82.8	80.0	86.9	88.3	77.3	78.7	82.8	77.3	76.0	69.6
12	80.0	80.0	82.8	80.0	84.9	88.3	76.0	78.7	82.8	77.3	74.7	69.6
13	80.0	80.0	82.8	82.8	80.0	88.3	76.0	78.7	82.8	80.0	74.7	69.6
14	80.0	85.5	82.8	80.0	88.0	88.3	76.0	78.7	82.8	82.8	76.0	69.6
15	80.0	82.8	85.5	81.4	80.0	88.3	76.0	78.7	82.8	82.8	74.7	68.4
16	80.0	80.0	85.5	81.4	88.0	88.3	76.0	78.7	81.4	81.4	74.7	[illegible]
17	80.0	82.8	85.5	81.4	78.7	88.3	76.0	78.7	81.4	80.0	74.7	[illegible]
18	80.0	82.8	85.5	82.8	78.7	81.4	76.0	80.0	82.8	80.0	74.7	67.1
19	82.8	82.8	85.5	81.4	78.7	81.4	74.7	80.0	85.5	78.7	74.7	65.9
20	80.0	82.8	85.5	81.4	78.7	81.4	76.0	80.0	85.5	78.7	74.7	65.9
21	80.0	80.0	85.5	92.8	78.7	82.8	74.7	80.0	85.5	78.7	74.7	65.9
22	80.0	80.0	82.8	82.8	78.7	82.8	74.7	80.0	85.5	78.7	76.0	65.9
23	77.3	82.8	82.8	81.4	78.7	80.0	74.7	78.7	81.4	78.7	77.3	65.9
24	80.0	80.0	82.8	81.4	78.7	80.0	74.7	78.7	81.4	77.3	80.0	65.9
25	80.0	80.0	82.8	81.4	78.7	80.0	74.7	78.7	85.5	77.3	80.0	65.9
26	80.0	80.0	88.3	80.0	80.0	78.7	74.7	78.7	85.5	77.3	74.7	65.9
27	80.0	80.0	80.0	80.0	80.0	78.7	74.7	78.7	85.5	77.3	77.3	65.9
28	80.0	85.5	77.3	78.7	80.0	78.7	74.7	78.7	85.5	77.3	80.0	65.9
29	80.0	109.8	95.5	78.7	80.0	80.0	73.6	78.7	85.5	77.3	74.7	64.6
30	80.0	......	100.3	108.8	80.0	78.7	73.6	78.7	85.5	77.3	73.4	64.6
31	80.0	......	100.3	......	78.7	......	77.3	78.7	......	77.3	......	65.9
Mean	80.0	82.5	88.1	83.4	84.8	80.1	76.3	78.8	83.5	79.4	76.2	68.6

Mean Daily Flow in Second-feet Skaneateles Outlet at Willow Glen Weir—(Continued).

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	72.2	64.5	64.6	85.5	80.0	40.5
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	69.6	65.5	64.6	85.5	116.2	37.2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	69.6	68.5	64.6	85.5	85.5	36.1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	60.6	63.5	64.6	85.5	95.5	36.1
[illegible]	[illegible]	......	[illegible]	[illegible]	[illegible]	34.1	60.6	69.5	64.6	85.5	92.7	36.1
[illegible]	[illegible]	......	[illegible]	[illegible]	[illegible]	26.1	60.6	64.5	64.6	85.5	77.8	36.1
[illegible]	[illegible]		[illegible]	....	23.0	....	60.6	64.5	....	85.5	....	36.1
Mean	[illegible]	[illegible]	[illegible]	9.07	18.6	34.2	46.8	60.1	67.4	[illegible]	83.7	30.4

*Reservoir closed.

Mean Daily Flow in Second-feet, Skaneateles Outlet at Willow Glen Weir—(Concluded).

Mean Monthly Run-off of Skaneateles Outlet, Jordan, N. Y.

[Drainage area, 92 square miles.]

MEAN MONTHLY FLOW IN SECOND-FEET.

MONTH.	1890.	1891.	1892.
January	....	....	....
February	....	....	....
March	....	....	....
April	....	....	....
May	....	....	....
June	....	127.8	....
July	....	115.8	....
August	....	153.1	129.5
September	156.8	146.6	116.5
October	153.9	149.7	121.2
November	155.2	....	114.6
December	161.6	....	....

SECOND-FEET PER SQUARE MILE.

MONTH.	1890.	1891.	1892.
January	....	....	....
February	....	....	....
March	....	....	....
April	....	....	....
May	....	....	....
June	....	1.38	....
July	....	1.24	....
August	....	1.65	1.39
September	1.70	1.59	1.26
October	1.66	1.61	1.31
November	1.67	....	1.24
December	1.73	....	....

Mean Monthly Run-off of Skaneateles Outlet, Jordan, N. Y.—(Concluded.)

INCHES ON DRAINAGE AREA.

MONTH.	1900.	1901.	1902.
January	....	....	....
February	....	....	....
March	....	....	....
April	....	....	....
May	....	....	....
June	....	1.55	....
July	....	1.43	....
August	....	1.59	1.59
September	1.90	1.73	1.42
October	1.91	1.85	1.52
November	1.67	....	1.39
December	2.61	....	....

Willow Glen Weir below Skaneateles, N. Y. Actual Run-off of Outlet in Second-feet.

[Drainage area, 74 square miles.]

MONTH.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
January	....	89.0	64.5	68.6	75.5	36.0	38.0
February	....	82.5	61.0	67.4	65.9	31.7	33.0
March	87.2	89.1	58.3	69.5	69.7	14.5	41.1
April	145.7	68.4	5.6	70.3	76.0	9.67	88.4
May	110.7	84.3	61.9	74.7	72.8	18.6	119.7
June	84.0	88.1	78.8	71.3	78.9	34.2	175.3
July	89.7	76.3	75.3	72.7	79.1	46.3	128.3
August	97.8	78.8	126.4	72.2	67.7	60.1	95.4
September	97.2	83.5	77.1	71.5	64.1	67.4	83.4
October	99.2	79.4	85.4	72.9	69.9	98.5	98.9
November	97.3	76.2	81.6	72.0	60.1	82.7	108.4
December	84.1	68.6	68.8	73.2	27.0	58.4	82.4

*Total Run-off of Skaneateles Outlet at Willow Glen Weir in Second-feet.**

[Drainage area, 74 square miles.]

MONTH.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
January	....	98.0	76.8	81.6	90.8	80.7	53.8
February	....	95.5	73.5	79.9	84.6	44.5	49.4
March	103.2	101.6	65.5	83.2	84.7	80.3	60.5
April	162.0	95.2	16.9	88.0	91.5	26.8	106.4
May	127.0	97.0	74.8	86.2	86.8	84.7	138.1
June	102.1	103.2	85.1	84.2	94.4	53.8	194.8
July	107.8	91.1	88.9	88.2	94.8	64.0	....
August	114.5	98.2	138.4	86.6	84.6	88.2	....
September	112.8	96.4	89.4	85.5	80.5	85.7	....
October	118.9	91.2	97.4	87.1	76.4	111.2	....
November	111.2	87.3	93.8	86.5	75.4	99.4	....
December	96.7	82.8	79.1	85.5	42.5	66.8	....

* Including diversion for water supply of Syracuse.

Sec. ft.
200

175

150

125

100

75

50

25

0

Fig. No. 22.—Discharge of Skaneateles Lake Outlet at Willow Glen Weir, Onondaga County, N. Y., 1896.

Sec. ft.
200

175

150

125

100

75

50

25

0

Fig. No. 23.—Discharge of Skaneateles Lake Outlet at Willow Glen Weir, Onondaga County N. Y., 1897.

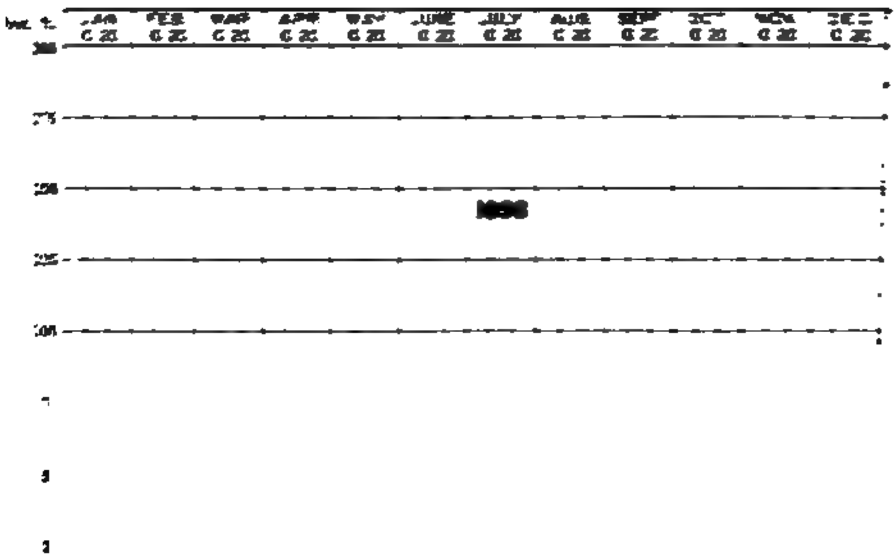

Fig. No. 24.—Discharge of Skaneateles Lake Outlet at Willow Glen Weir, Onondaga County, N. Y., 1898.

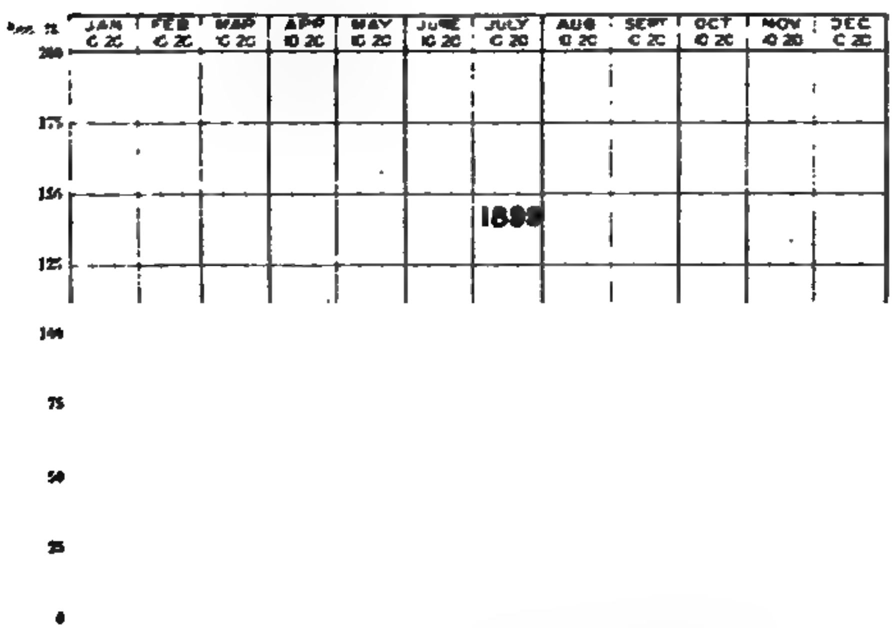

Fig. No. 25.—Discharge of Skaneateles Lake Outlet at Willow Glen Weir, Onondaga County, N. Y., 1899.

Fig. No. 26.—Discharge of Skaneateles Lake Outlet at Willow Glen Weir, Onondaga County, N. Y., 1900.

Fig. No. 27.—Discharge of Skaneateles Lake Outlet at Willow Glen Weir, Onondaga County, N. Y., 1901.

*Mean Monthly Run-off of Skaneateles Outlet at Willow Glen Weir in Second-feet per Square-mile.**

[Drainage area, 74 square miles.]

MONTH.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
January	....	1.25	1.04	1.10	1.23	.41	.73
February	....	1.29	.99	1.06	1.14	.60	.67
March	1.39	1.38	.88	1.11	1.14	.41	.82
April	2.18	1.28	.23	1.12	1.24	.36	1.43
May	1.71	1.31	1.00	1.16	1.17	.47	1.86
June	1.37	1.38	1.15	1.14	1.27	.71	2.63
July	1.46	1.23	1.20	1.19	1.28	.87	....
August	1.55	1.24	1.86	1.17	1.14	1.19	....
September	1.51	1.30	1.21	1.15	1.09	1.16	....
October	1.54	1.28	1.31	1.18	1.06	1.49	....
November	1.49	1.18	1.24	1.15	1.02	1.34	....
December	1.31	1.12	1.07	1.15	0.57	.91	....

*Including diversion for water supply of Syracuse.

*Mean Monthly Run-off of Skaneatelas Outlet at Willow Glen Weir in Inches on Drainage Area.**

[Drainage area, 74 square miles.]

MONTH.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
January	....	1.44	1.19	1.27	1.41	.47	.84
February	....	1.39	1.03	1.12	1.19	.62	.69
March	1.59	1.59	1.01	1.28	1.31	.47	.94
April	2.44	1.43	.26	1.25	1.39	.40	1.60
May	1.97	1.51	1.15	1.33	1.35	.54	2.14
June	1.53	1.55	1.29	1.28	1.42	.79	2.95
July	1.68	1.41	1.38	1.36	1.47	1.00	....
August	1.78	1.43	2.14	1.35	1.31	1.37	....
September	1.69	1.46	1.35	1.29	1.22	1.30	....
October	1.77	1.41	1.51	1.36	1.18	1.71	....
November	1.67	1.32	1.39	1.29	1.14	1.50	....
December	1.51	1.29	1.23	1.32	0.66	1.05	....
Total	17.63	17.23	14.93	15.50	15.05	11.22	9.16

*Including diversion for water supply of Syracuse.

Mean Monthly Run-off of Skaneateles Lake at State Dam, Skaneateles, N. Y.

[Drainage area, 73 square miles.]

MONTH.	SECOND-FEET.		SECOND-FEET PER SQUARE MILE.		INCHES ON DRAINAGE AREA.	
	1890.	1891.	1890.	1891.	1890.	1891.
January	....	102.9	....	1.43	....	1.64
February	....	115.2	....	1.58	....	1.64
March	....	182.7	....	2.51	....	2.89
April	....	186.6	....	2.56	....	2.87
May	....	116.4	....	1.59	....	1.83
June	....	96.4	....	1.32	....	1.48
July	....	94.9	....	1.30	....	1.49
August	....	....	....	....	....	....
September	117.8	....	1.62	....	1.81	....
October	100.88	....	1.38	....	1.59	....
November	107.5	....	1.48	....	1.66	....
December	113.4	....	1.55	....	1.78	....

SENECA RIVER AT BALDWINSVILLE, ONONDAGA COUNTY, N. Y.

This gauging station has been described in Water Supply and Irrigation Paper No. 36, page 183. Seneca River drains the central lake region of New York. The outlets of Otisco, Skaneateles and Owasco Lakes are crossed by the Erie canal, and a portion of their flow is intercepted for water supply purposes. Water from Lake Erie feeds the main canal as far as Port Byron. Some of this water is discharged into Seneca River and thence returned to Lake Ontario.

The upper reaches of the stream are canalized, forming the Cayuga and Seneca canals, while dams on the lower portion admit of slackwater navigation, forming a part of Oswego canal. During the summer but little water flows over the dam at Baldwinsville. In times of low water, the mills are only allowed to run a certain number of hours during the day, or until the supply accumulated in the pond above the dam is drawn down to a certain level.

The water is diverted through three power canals and conducted to the water wheels by means of short lateral channels. Power is used at ten mills having a total of over 40 water wheels.

Current meter measurements at Baldwinsville have been made as follows:

DATE.	Discharge, second-feet.
June [illegible], 190[illegible]:	
Oswego canal *a*	504.5
Main stream at railroad bridge	1,183
Total flow	1,[illegible]
Flow in Amos race on same date	194
September [illegible], 190[illegible] (no water flowing over dam):	
South side canal	[illegible]
Oswego canal	[illegible]
Amos race	[illegible]
Total flow	959

a Including South Side canal and Amos race.

Fig. No. 28.—Seneca River Gauging Station: State dam at Baldwinsville, Onondaga County, N. Y.

Owing to leakage of water wheels and penstocks, great difficulty is experienced in securing accurate results during low water at Baldwinsville. The stream has been examined at various other points with reference to the possible establishment of a current meter station, and the following current meter measurements have been made:

Seneca River at Belgium (New Bridge), N. Y.

DATE.	Measured discharge, second-feet.
May 28, 1901	5,279
June 6, 1901	5,014

Seneca River at Jack's Reef bridge, September 11, 1901:

Discharge at Jack's Reef bridge.... 1,651 second-feet.
Discharge in "cut off"............. 83 second-feet.
Total flow .... 1,734 second-feet.

Owing to slackwater in the channels, backwater from dams below and other causes, it has been found that the above stations could not be utilized at all stages of the stream. During 1901, repairs to the penstocks, water wheels, etc., at a number of the Baldwinsville mills have been made, greatly reducing the leakage, and the record at that station has been continued.

Mean Monthly Run-off of Seneca River at Baldwinsville, N. Y.

[Drainage area, 3,103 square miles.]

MEAN MONTHLY FLOW IN SECOND-FEET.

MONTH.	1898.	1899.	1900.	1901.
January	....	2,951	....	....
February	....	1,769	....	....
March	....	3,575	....	....
April	....	4,548	....	....
May	....	2,568	....	....
June	....	1,578	....	....
July	....	776	....	....
August	....	455	....	....
September	....	481	....	....
October	....	687	....	....
November	3,142	1,612	....	....
December	2,689	1,722	....	....

Mean Monthly Run-off of Seneca River at Baldwinsville, N. Y.—(Concluded.)

SECOND FEET PER SQUARE MILE.

MONTH.	1898.	1899.	1900.	1901.
January		0.92		
February		0.57		
March		1.25		
April		1.46		
May		0.88		
June		0.51		
July		0.22		
August		0.15		
September		0.15		
October		0.20		
November	1.01	0.52		
December	0.87	0.55		

INCHES ON DRAINAGE AREA.

MONTH.	1898.	1899.	1900.	1901.
January		1.06		
February		0.59		
March		1.44		
April		1.63		
May		0.96		
June		0.57		
July		0.25		
August		0.17		
September		0.17		
October		0.24		
November	1.15	0.58		
December	1.00	0.63		

Mean Daily Flow in Second-feet of Seneca River at Baldwinsville, N. Y.

[Drainage area, 3,103 square miles.]

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1898.												
1												[illegible]
2												[illegible]
3												[illegible]
4												[illegible]
5												[illegible]
6												[illegible]
7												[illegible]
8												[illegible]
9												[illegible]
10												[illegible]
11												[illegible]
12											3,011	[illegible]
13											2,625	[illegible]
14											3,583	[illegible]
15											3,654	[illegible]
16											3,300	[illegible]
17											3,419	[illegible]
18											3,270	[illegible]
19											3,308	[illegible]
20											2,590	[illegible]
21											3,293	[illegible]
22											3,174	[illegible]
23											3,234	[illegible]
24											3,236	[illegible]
25											3,237	[illegible]
26											3,245	[illegible]
27											2,452	[illegible]
28											3,119	3,449
29											2,810	[illegible]
30											2,801	[illegible]
31												[illegible]
Mean											3,142	[illegible]

Fig. No. 29.—Discharge of Seneca River at Baldwinsville, Onondaga County, N. Y., 1899.

Mean Daily Flow in Second-feet of Seneca River at Baldwinsville, N. Y.—(Concluded).

ONEIDA RIVER AT BREWERTON, ONONDAGA COUNTY, NEW YORK.

Oneida River is a stream 16 miles in length connecting Oneida Lake, of which it forms the outlet, with Seneca River at Three River Point, where the two unite to form the Oswego River. A record of the water level at the foot of the lake at Brewerton was kept in connection with the Topographical Surveys of the United States Deep Waterways from June 1st to September 9th, 1899. The record has been furnished by Albert J. Himes by whom it was established.

The gauge erected by the United States Deep Waterways at Brewerton was an 8-foot board divided to feet and tenths, attached horizontally to the downstream face of pier of foot bridge across the channel leading to Zett's Island at foot of lake. A lead weight and a wire running over a pulley, were used to take readings. Some uncertainty exists as to the accuracy of the latter portion of the record, owing to changing of the weight and wire. Gauge readings were taken twice each day by George H. Meeker. The channel where the gauge was placed

is situated at the foot of the lake just above the highway bridge across Oneida River. Its water surface is subject to the same fluctuations of level as the lake surface, except during extreme low water, when owing to its rapid fall the elevation of the water in the channel is affected by surface slope. No current meter discharge measurements have been made at Brewerton.

At Caughdenoy, about three miles downstream from Brewerton, occurs a natural rift where a series of five eel weirs have been constructed, consisting of W-shaped barriers across the stream, with openings in the form of lattice work through which the water passes; the crests of the eel weirs being near the water surface. The combined fall produced by these weirs at Caughdenoy is four feet. A lock on the left-hand side affords means for navigation past the weirs. A water power privilege also exists in connection with the canal and lock at Caughdenoy where a fall of 4 feet has been obtained.

Daily Gauge Height of Oneida River at Brewerton, N. Y.

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1899.												
1						3.18	2.02	1.67	1.19			
2						3.10	2.00	1.75	1.16			
3						3.10	1.94	1.65	1.19			
4						3.10	1.94	1.66	1.13			
5						3.02½	1.95	1.64	1.10			
6						3.02	1.86	1.64	1.05			
7						2.95	1.88	1.63	1.02			
8						2.75	1.80	1.62	1.02			
9						2.84	1.79	1.62	.98			
10						2.78	1.79	1.70				
11						2.74	1.88	1.75				
12						2.70	1.85	1.67				
13						2.62	1.85	1.51				
14						2.60	1.78	1.51				
15						2.55	1.80	1.57				
16						2.60	1.78	1.48				
17						2.60	1.78	1.43				
18						2.50	1.68	1.42				
19						2.50	1.78	1.39				
20						2.44	1.79	1.40				
21						2.30	1.74½	1.42				
22						2.39	1.71	1.25				
23						2.35	1.76	1.27				
24						2.26	1.84	1.25				
25						2.26	1.98					
26						2.30	1.80	1.23				
27						2.28	1.79	1.30				
28						2.24	1.80	1.22				
29						2.13	1.76	1.23½				
30						2.08	1.65	1.21				
31							1.60	1.22				

At Oak Orchard is a State dam and lock, the latter having a lift of 3.5 feet. On the left bank of the stream is an abandoned water power privilege. The dam is of timber with gravel back-

ing, curved in plan. A short distance down stream is situated a highway bridge of six spans, where the conditions are favorable for measuring the stream with a current meter. During extreme high water the dams at Oak Orchard and Caughdenoy become entirely submerged. At such times backwater from the Phoenix dam on Oswego River extends to Oneida Lake, producing a smooth surface curve the entire length of Oneida River.

LOW WATER GAUGINGS OF OSWEGO RIVER AT FULTON, OSWEGO COUNTY, N. Y.

The following table shows a summary of measurements to determine the flow of Oswego River for water power purposes at the lower dam in Fulton. The measurements were made and the results furnished by O. C. Breed, C. E.

The water power at the dam is used jointly by five mills, each being entitled to the flow through an orifice of a certain area under the available head. In order to ascertain the amount of water used by each, the water was allowed to flow through openings formed in thin partitions in the sides of the bulkheads. The discharge through these openings was calculated by the formula for orifices, using a coefficient 0.62.

Observations of the head on the orifices were taken at thirty-minute intervals throughout twenty-four hours each day. A record was also kept of the elevation of water surface above the crest of the dam. The elevation of the masonry crest of the dam is 102.00. The dam is surmounted by flashboards having a top elevation 103.20. The water did not often flow over the flashboards. Such overflow, when it took place, has been calculated by means of the Francis formula, the length of the clear crest being 521 feet. The mean flow-rate for each one-half hour period has been obtained by summation of the discharge through the several orifices, and the flow over flashboards, if any. The mean daily flow in the table is the average of forty-eight such separate measurements.

Estimated Minimum Flow of Oswego River at Fulton, N. Y., in 1900.

DATE.	MEAN DAILY FLOW.		Maximum daily flow second feet.	Minimum daily flow second feet.
	Second feet.	Second feet per square mile.		
1900.				
October 29	1,980	0.40	2,083	1,235
October 30	1,671	0.33	2,080	[illegible]
October 31	1,776	0.36	2,298	[illegible]
November 1	1,849	0.38	2,430	[illegible]
November 2	1,752	0.36	2,301	[illegible]
November 3	1,810	0.37	2,250	[illegible]
November 4 *a*				
November 5	1,665	0.34	2,280	[illegible]
November 6	1,930	0.39	2,351	[illegible]
November 7	1,842	0.37	2,471	[illegible]
November 8	1,890	0.38	2,415	[illegible]
November 9	1,611	0.33	2,470	[illegible]
November 10	1,822	0.37	2,345	1,288

When the water stood at an elevation exceeding 102.00, a small amount of leakage took place through joints and cracks in flashboards. This occurred but for a few hours each day. The exact amount of such leakage is indeterminate, but the average rate, when distributed through the entire day, is so small that no serious error is introduced in the table by neglecting it.

The drainage area above the dam is 4916 square miles, and the table shows a minimum run-off of one-third second foot per square mile in 1900. The measurements given above were checked by rod floats through a 600-foot section of the river channel with rock bottom.

OSWEGO RIVER ABOVE MINETTO, OSWEGO COUNTY, N. Y.

Oswego River is formed by the junction of Oneida and Seneca Rivers at Three River Point. It has extensive natural storage in Oneida Lake, which covers an area of 80 square miles, and in the Finger Lakes of Central New York which it drains. Certain of the tributary lakes serve as reservoirs for the water supply of the middle division of Erie Canal and a portion of their outflow is diverted for this purpose.

a Sunday.

Mean Daily Gauge Readings of Elevation of Water Surface of Oswego River above Minetto, N. Y.
(Drainage area 4,[illegible]00 square miles).

NOTE.—The plane of reference of the above gauge readings is an arbitrary one which is taken as one hundred feet below a spike at the foot of a large basswood tree three hundred feet northwest of the gauge, which is about six hundred feet down stream from the Battle Island dam.

Estimated Pondage Areas in Oswego River Drainage Basin. (a)

STREAM BASIN.	Drainage area, square miles.	Area of water surface, square miles.	Flats and marsh, square miles.	Total pondage area, square miles.	Percentage of entire drainage area.
Seneca	[illegible]	225	[illegible]	[illegible]	
Oneida	[illegible]	[illegible]	[illegible]	[illegible]	
Oswego	[illegible]	4	3	[illegible]	
Total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Oswego River has been canalized by the construction of dams affording slack-water navigation on a part of the stream. Surplus water at the State dam supplies power to the numerous mills situated along the adjacent banks. Lateral canals and locks carry boats around the dams and connect with back-water from the next succeeding dam in each instance.

In establishing a gauging station it was impossible to measure the entire stream in a single channel, since in order to avoid slackwater from dams, it was necessary to select a site where the river is paralleled by the canal. A cable station was established September 14, 1900, three miles above Minetto and six-tenths mile below the State dam at Battle Island. The cable has a clear span of 376 feet between supports on the banks.

The stream channel underneath has a smooth sandstone bed. The gauge board was placed on the left bank about one-eighth of a mile downstream from the dam. A weight gauge is used, being suspended from a frame-work projecting over the water, beyond the low water margin. The position of the weight when the gauge reads zero has been determined with reference to an arbitrarily fixed bench mark, and the gauge readings are reduced to equivalent elevations of water surface referred to this bench mark. Morning and evening readings are taken, usually 12 hours apart, by H. L. Woodcock, and the average of the two readings is given in the tables.

The current meter measurements given below do not include diversion through Oswego canal.

a Based upon table at p. 784, Report U. S. Board of Engineers on Deep Waterways, 1900.

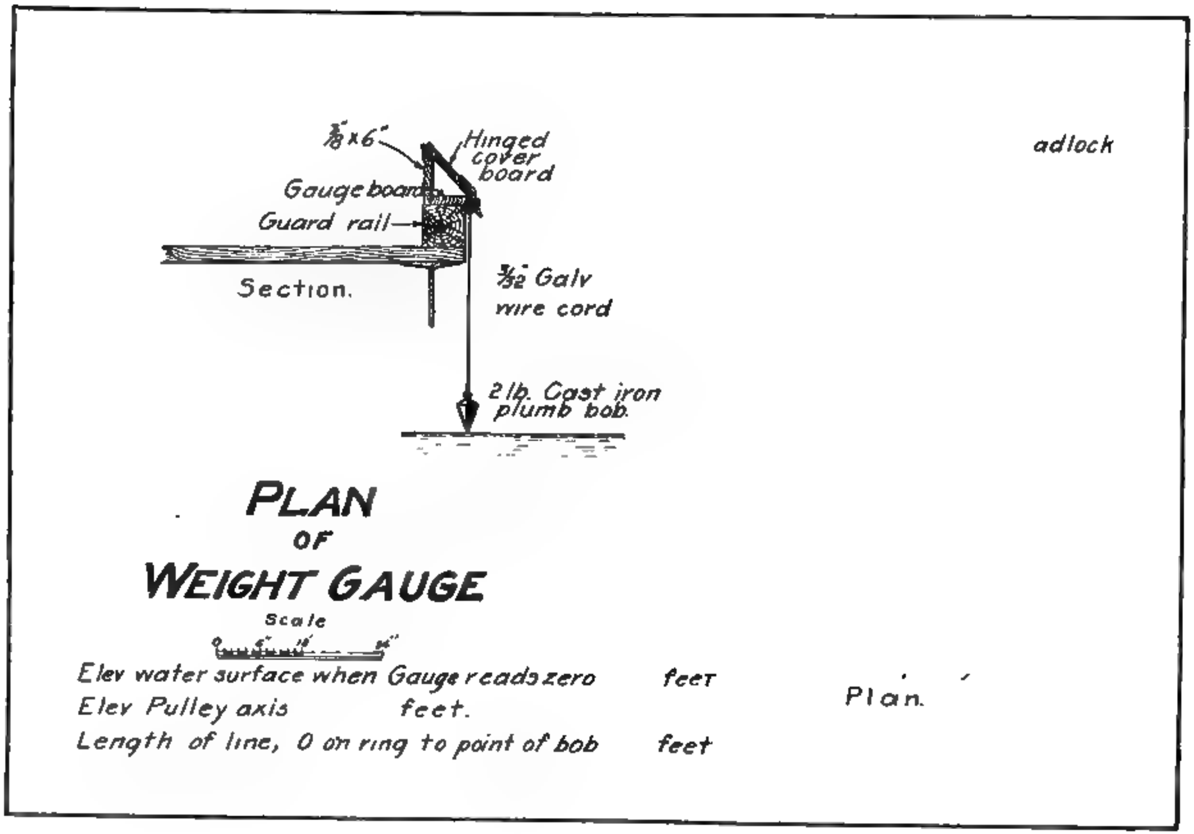
⅞"x6"
Hinged cover board
Gauge board
Guard rail
Section.
3/32" Galv wire cord
2 lb. Cast iron plumb bob.
adlock
PLAN OF WEIGHT GAUGE
Scale
Elev water surface when Gauge reads zero feet
Elev Pulley axis feet.
Length of line, 0 on ring to point of bob feet
Plan.

Fig. No. 30.

Current Meter Discharge Measurements of Oswego River at Cable Station.

DATE.	Elevation of water surface, feet.	Discharge, second-feet.	Hydrographer.
September 15, 1900	83.57	1,677	R. E. Horton.
August 27, 1901	84.97	2,988	E. C. Murphy.
August 27, 1901	85.07	3,208	E. C. Murphy.
August 28, 1901	85.09	3,169	E. C. Murphy.
August 28, 1901	85.09	3,066	E. C. Murphy.
August 7, 1901	85.12	3,277	E. C. Murphy.
August 7, 1901	85.14	3,224	E. C. Murphy.
July 12, 1901	86.24	5,264	E. C. Murphy.
May 23, 1901	88.85	6,982	R. E. Horton.
April 13, 1901	92.77	18,452	R. E. Horton.

On April 13, 1901, the depth of water flowing over the Battle Island dam, one-eighth mile above the gauge was observed for comparison with the current meter measurement. The calculated discharge over the dam was 17,520 second-feet, not including leakage. The lowest water on the stream usually occurs Sundays, due to the stopping of waterwheels and the consequent filling of mill ponds at Fulton, four miles upstream.

In this connection, reference may be made to the gauging record which was maintained by the United States Board of Engineers on Deep Waterways on Oswego River at the Oswego Falls dam, from November, 1898, to May, 1899, inclusive. Description of this station may be found in Water Supply Paper of United States Geological Survey, No. 36, page 188. The drainage areas tributary to Oswego River at the different gauging stations are as follows:

Drainage Areas of Oswego River.

LOCATION.	Drainage area, square miles.
Mouth	5,002
High dam	5,000
Cable station	4,990
Fulton	4,916

OSWEGO RIVER AT HIGH DAM, OSWEGO COUNTY, N. Y.

This is a State dam on Oswego River, three miles from Lake Ontario, having its crest 32 feet higher than mean lake level and affording an effective head of about 13 feet. The record is kept by the Oswego Waterworks Company, and has been furnished by Thos. H. Bennett, Superintendent. The distance down to the water surface in the pond above the dam is measured from the top of a bulkhead, having a known elevation with reference to the crest of the dam. Gauge readings are taken daily, with the exception of Sundays and holidays.

Owing to the use of the stream for navigation purposes, an effort is made to keep the water up to a certain level at all times. The dam is of masonry, with a crest 365.5 feet long. Flashboards are maintained on the dam during the greater part of the year. When flashboards are on, the flow over the dam has been computed by means of the Francis formula. In estimating the flow when flashboards are removed, a discharge curve has been prepared using coefficients in the weir formula derived from Cornell Experiment No. 3,[a] and taking into consideration the irregularities in the profile of the crest. Since the record was started, the water has not been down low enough to afford an opportunity for making a new profile of the dam. One which was made in 1896 has been used in the calculations.

No opportunity has been offered for directly measuring the leakage of the dam. Owing to the leakage and possible settlement of the dam since the profile used was obtained, the records as calculated probably give considerably too small results for low water, and may be revised upon the acquisition of new data. A headrace at the left-hand end of the dam diverts water to supply an electric light plant and waterworks pumping station. Eight water wheels are in use. A regular record of the run of the water wheels has not been kept and the diversion for this purpose has been estimated from current meter measurements made in the headrace.

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a See Transactions, Am. Soc. C. E., Vol. XLIV, p. 274

Fig. No. 31.—Cable Station on Oswego River, eight miles from Lake Ontario, Oswego County, N. Y.

Fig. No. 32.—N. Y. State High Dam on Oswego River, three miles from Lake Ontario, Oswego County, N. Y.

Measured Flow in Headrace at High Dam.

DATE.	Working head on wheels, feet.	Measured discharge (second-feet).
June 12, 1900	13	328
September 15, 1900	14	352

Three pairs of wheels, which were running when each of the above measurements were made, are run 24 hours per day. Taking the average of the above measurements and allowing 105 second-feet for the additional pair of wheels, the diversion for water power has been taken at 450 second-feet, as a round figure. The flow over the auxiliary spillway at the end of the headrace has been calculated by the weir formula using coefficients derived by Bazin for a dam having a similar cross section. Some uncertainty attaches to the record at High Dam during the spring months, owing to the carrying away of the flashboards by high water at dates not definitely ascertained. In the accompanying tables of monthly and daily mean flow no allowance has been made for diversion to the Oswego Canal.[a]

[a] Tables of daily gauge heights, etc., at this station are given in Water Supply Paper of U. S. Geol. Survey, No. 36, p. 189.

Mean Daily Flow in Second-feet of Oswego River at "High Dam," Two Miles Above Oswego, N. Y.

[Drainage area, 5,000 square miles.]

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
[illegible]												
1	......	......	......	[illegible]	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]	[illegible]	[illegible]
3	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]	......*	[illegible]	[illegible]
4	......	......	......	......*	[illegible]	[illegible]	......*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	......	......	......	[illegible]	[illegible]	......	[illegible]	[illegible]	......*	[illegible]	[illegible]	[illegible]
6	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]	[illegible]	[illegible]	......
7	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......*	[illegible]
8	......	......	......	[illegible]	......	[illegible]	[illegible]	......*	[illegible]	[illegible]	[illegible]	[illegible]
9	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......*	[illegible]	[illegible]
11	......	......	......	[illegible]	[illegible]	[illegible]	......*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	......	......	......	[illegible]	......	......	[illegible]	[illegible]	......*	[illegible]	[illegible]	......*
13	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	......	......	......	[illegible]	......	[illegible]	[illegible]	......*	[illegible]	[illegible]	[illegible]	[illegible]
16	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]
17	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......*	[illegible]	[illegible]
18	......	......	......	[illegible]	[illegible]	[illegible]	......*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	......	......	......	[illegible]	[illegible]	......	[illegible]	[illegible]	......*	[illegible]	[illegible]	......*
20	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......*	[illegible]
22	......	......	......	[illegible]	......	[illegible]	[illegible]	......*	[illegible]	......	[illegible]	[illegible]
23	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......*	[illegible]	[illegible]
25	......	......	......	[illegible]	[illegible]	[illegible]	......*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
26	......	......	......	[illegible]	[illegible]	......	[illegible]	[illegible]	......*	[illegible]	[illegible]	......*
27	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......*	[illegible]
29	......	......	......	[illegible]	......	[illegible]	[illegible]	......*	[illegible]	[illegible]	[illegible]	[illegible]
30	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
31	......	......	......	......	[illegible]	......	[illegible]	[illegible]	......	......*	......	[illegible]
Mean	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]												
1	[illegible]	[illegible]	[illegible]	[illegible]	......*	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]	[illegible]
2	......*	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	......*	[illegible]	[illegible]	......*	[illegible]	[illegible]	......	[illegible]	......
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]	[illegible]	[illegible]	......	[illegible]
6	[illegible]	......*	......*	[illegible]	[illegible]	[illegible]	......	[illegible]	[illegible]	......	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]	......*	[illegible]	......	[illegible]	[illegible]	......	[illegible]	[illegible]
9	......*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	......*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]
13	[illegible]	......*	......*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]	[illegible]	......	[illegible]	[illegible]
16	......*	[illegible]	[illegible]	[illegible]	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	[illegible]	[illegible]	[illegible]	......*	......	[illegible]	......*	[illegible]	[illegible]	[illegible]	[illegible]	......
18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]	[illegible]	[illegible]	......	[illegible]
20	[illegible]	......*	......*	[illegible]	......	[illegible]	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	[illegible]	[illegible]	[illegible]	[illegible]	......*	[illegible]	......	[illegible]	[illegible]	......	[illegible]	[illegible]
23	......*	[illegible]	[illegible]	[illegible]	6,850	[illegible]	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24	[illegible]	[illegible]	[illegible]	......*	......	[illegible]	......*	[illegible]	[illegible]	[illegible]	[illegible]	......
25	[illegible]	[illegible]	[illegible]	[illegible]	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
26	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......*	......	[illegible]	[illegible]	[illegible]	......	[illegible]
27	[illegible]	......*	......*	[illegible]	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29	[illegible]	......	[illegible]	[illegible]	......*	[illegible]	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
30	......*	......	[illegible]	[illegible]	......	[illegible]	......	[illegible]	[illegible]	......*	[illegible]	[illegible]
31	[illegible]	......	[illegible]	......	6,556	......	......*	[illegible]	......	[illegible]	......	......
Mean	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4,331	1,934	985	[illegible]	2,018	[illegible]	[illegible]

* Sundays.

Mean Daily Flow in Second-feet of Oswego River at "High Dam," Two Miles Above Oswego, N.Y
—(Continued).

*Sundays.

Mean Daily Flow in Second-feet of Oswego River at High Dam, Oswego County, N. Y.—Continued.

[Drainage area, [illegible] square miles.]

Day.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
26	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
30	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
31	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]		[illegible]		[illegible]
Mean	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

a Exceeds limit of rating curve. * Sunday.

Mean Monthly Run-off of Oswego River at High Dam, Oswego County, N. Y.

[Drainage area, [illegible] square miles.]

MEAN MONTHLY FLOW IN SECOND-FEET.

MONTH.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
January	....	[illegible]	[illegible]	[illegible]	[illegible]
February	....	[illegible]	[illegible]	[illegible]	[illegible]
March	....	[illegible]	[illegible]	[illegible]	[illegible]
April	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
May	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
June	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
July	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
August	[illegible]	925	[illegible]	[illegible]	[illegible]
September	1,344	[illegible]	[illegible]	[illegible]	[illegible]
October	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
November	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
December	4,198	[illegible]	[illegible]	[illegible]	[illegible]

Fig. No. 23.—Discharge of Oswego River at High Dam, three miles from Lake Ontario at Oswego, Oswego County, N. Y., 1897.

Fig. No. 24.—Discharge of Oswego River at High Dam, three miles from Lake Ontario at Oswego, Oswego County, N. Y., 1898.

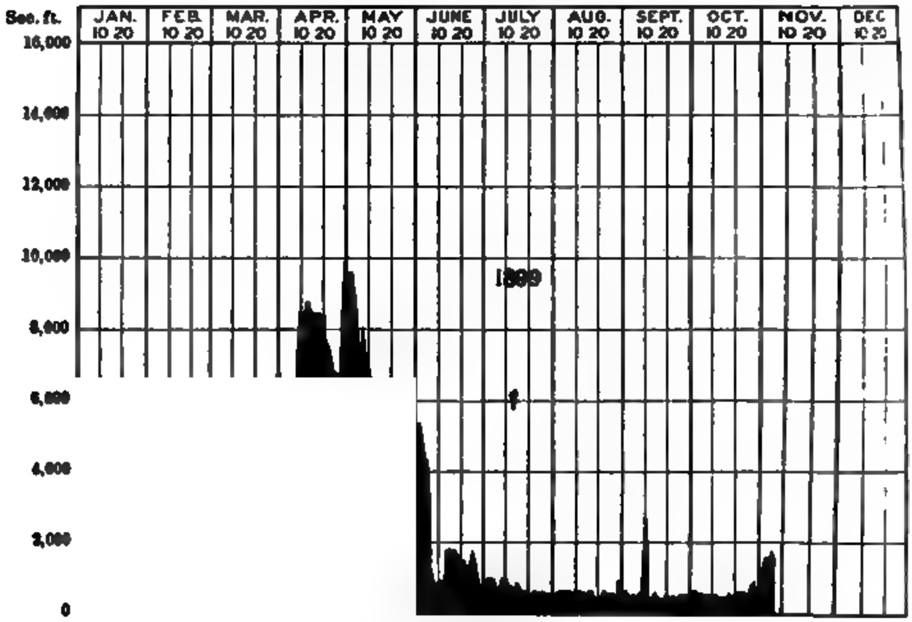

Fig. No. 35.—Discharge of Oswego River at High Dam, three miles from Lake Ontario at Oswego, Oswego County, N. Y., 1899.

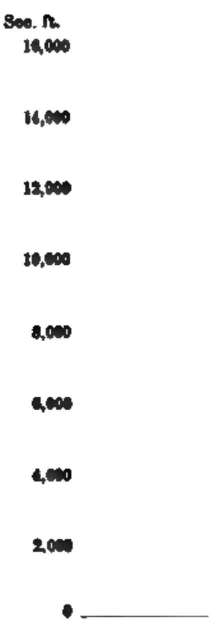

Fig. No. 36.—Discharge of Oswego River at High Dam, three miles from Lake Ontario at Oswego, Oswego County, N. Y., 1900.

Fig. No. 37.—Discharge of Oswego River at High Dam, three miles from Lake Ontario at Oswego, Oswego County, N. Y., 1901.

Mean Monthly Run-off of Oswego River at High Dam, Oswego County, N. Y.—(Concluded).

SECOND-FEET PER SQUARE MILE.

MONTH.	1897.	1898.	1899.	1900.	1901.
January	....	0.98	0.85	0.61	1.07
February	....	1.24	0.49	0.93	.87
March	....	1.99	0.97	0.99	1.45
April	2.00	1.51	1.58	2.80	3.39
May	1.28	1.63	1.35	1.58	2.00
June	0.76	1.66	0.40	0.62	1.63
July	0.48	0.36	0.15	0.19	.75
August	0.47	0.18	0.12	0.13	.39
September	0.25	0 27	0.12	0.13	.37
October	0.21	0.40	0.11	0.17	.43
November	0.36	0.89	0.21	0.48	.58
December	0.83	0.78	0.32	1.80	1.36

INCHES ON DRAINAGE AREA.

MONTH.	1897.	1898.	1899.	1900.	1901.
January	....	1.13	0.98	0.70	1.23
February	....	1.29	0.51	0.96	.88
March	....	2.29	1.12	1.14	1.67
April	2.23	1.68	1.70	3.12	3.80
May	1.78	1.78	1.55	1.76	2.30
June	0.85	1.85	0.44	0.69	1.83
July	0.49	0.41	0.17	0.22	.56
August	0.54	0.20	0.14	0.15	.45
September	0.28	0.30	0.13	0.14	.41
October	0.24	0.46	0.12	0.19	.49
November	0.40	0.99	0.24	0.58	.65
December	0.95	0.90	0.36	2.06	1.57

GENESEE RIVER AT ROCHESTER, MONROE COUNTY, N. Y.

Genesee River rises in Potter County, Pa. It flows northerly, crossing the State of New York, and entering Lake Ontario at Charlotte. There is a total fall of 263 feet within the city of Rochester, chiefly divided between three cascades, with an aggregate abrupt pitch of 205 feet, the remaining fall being distributed between dams and rapids. There are extensive water-power developments at each fall.[a] In the vicinity of Portage the stream flows through a narrow gorge in Niagara limestone, where a total fall of 330 feet occurs. Of this about 266 feet is in three abrupt pitches. There is a descent, including rapids, of 70, 110 and 150 feet, respectively, at the three principal falls.

Beginning in March, 1893, a record has been kept of the daily elevation of water surface in the pond above Johnson and Sey-

[a] Tenth U. S. Census Vol. 16, pp. 460–470; also Report of N. Y. State Engineer and Surveyor, 1896, pp. 714 and 715.

mour dam in Rochester. This record has been furnished by Mr. E. A. Fisher, City Engineer. The final results are not ready for publication. The following tables show a summary of the monthly variations in water level. The Johnson and Seymour dam affords power for 25 mills under a head of 19 feet. Water is drawn through two canals, one at each end of the dam. These canals take the entire flow of the stream during dry months. A State dam, a short distance upstream, diverts water for supply of Erie canal. Previous gauging records for Genesee River have been published in the reports of the State Engineer and Surveyor of New York and of United States Geological Survey as described below.

A gauge board was placed above the timber dam of the Mount Morris Hydraulic Power Company by Aug. Kibbie, and a record kept there from June 17 to December 2, 1890. The flow over the dam, which had a somewhat irregular crest 337 feet in length, was computed by the weir formula, using a constant coefficient of 3.4. An allowance of 160 second-feet was made for leakage and diversion for power purposes. The results of Mr. Kibbie's gaugings are to be found in Report of New York State Engineer and Surveyor, 1890, Plate 11, Appendix F.

In May, 1893, a gauge was reestablished at the Mount Morris dam by George W. Rafter. Diagrams showing the results of these gaugings for the period from August, 1893, to January, 1895, inclusive, and February, 1895, to November, 1896, inclusive, are to be found in the reports of the State Engineer and Surveyor, 1894, page 336, and 1896, page 644, respectively. During the summer of 1896 a sharp edged weir was established in Genesee River, two and one-half miles below the Mount Morris dam. Simultaneous observations taken at the weir and dam were used to accurately calibrate the latter for flows up to 5,000 second-feet. The Francis formula was used for calculating the flow over the weir. The corrected monthly mean flows, September, 1893, to November, 1896, inclusive, are given in the Twentieth Annual Report of United States Geological Survey, part 4, pages 225–227. The sharp edged weir at Mount Morris was

injured by flood in October, 1896, and has never been repaired. The Old Mount Morris dam was carried away by high water March, 1897.

Drainage Areas Tributary to Genesee River

LOCATION.	Square miles.
Portage Falls	1,000
Mount Morris	1,070
Rochester	2.865
Mouth	2,446

Unusual floods have occurred on Genesee river in 1815, 1835, 1857, 1865 and 1896.[a] The following are the calculated maximum rates of discharge:

LOCATION.	Date.	Second-feet.	Second-feet. per square mile.
Rochester	March 19, 1865	40,000	17.0
Rochester	June 1, 1889	27,000	11.4
Mount Morris	May 2, 1894	42,000	39.2

The lesser intensity of floods at Rochester is attributed largely to surface storage due to flooding of extensive intervening flat lands bordering the river.

Monthly Topographical Elevation of the Genesee River at the Johnson and Seymour Dam, Rochester, N. Y.

NOTE.—The elevation of the crest of the Johnson and Seymour dam is 241.91.

MONTH.	1893. Maximum elevation.	1894. Maximum elevation.	1895. Maximum elevation.	1896. Maximum elevation.	1897. Maximum elevation.	1898. Maximum elevation.	1899. Maximum elevation.
January	....	244.86	243.33	243.55	244.08	245.44	245.85
February	....	244.93	242.31	244.58	242.91	246.15	244.15
March	246.41	247.04	245.24	246.96	246.13	245.56	245.17
April	244.65	246.08	246.26	249.47†	244.20	245.25	244.92
May	245.78	248.34	242.43	242.49	243.86	243.85	243.09
June	241.65*	245.20	242.28	243.12	242.22	242.57	242.11
July	240.88*	242.17	241.99	242.18	242.71	242.27	241.10*
August	241.40*	242.13	241.77*	242.80	242.50	243.53	239.40*
September	243.68	245.18	241.71*	240.73*	240.40*	241.99	240.27*
October	243.43	243.52	239.88*	245.55	240.27*	243.60	240.33*
November	243.65	243.16	242.57	242.92	242.71	245.55	242.36
December	246.36	242.85	245.29	244.18	243.75	245.85	243.75
Year	246.41	248.34	246.26	249.47	246.18	246.15	242.71

a Described in Report N. Y. State Engineer and Surveyor, 1896, pp. 639–644.

* Elevation of water below crest of dam.

† Highwater of April 1, 1896.

Monthly Topographical Elevation of the Genesee River at the Johnson and Seymour Dam, Rochester, N. Y.—(Continued).

MONTH.	1893. Minimum elevation.	1894. Minimum elevation.	1895. Minimum elevation.	1896. Minimum elevation.	1897. Minimum elevation.	1898. Minimum elevation.	1899. Minimum elevation.
January	....	242.23	241.29*	241.70*	241.15*	240.45	[illegible]
February	....	242.12	240.81*	242.23	241.42*	242.08	[illegible]
March	241.93	242.54	243.09	242.44	242.29	[illegible]	[illegible]
April	241.95	242.66	242.34	242.49	242.67	242.28	[illegible]
May	241.76*	242.84	241.88*	241.50*	242.15	242.57	[illegible]
June	239.96*	242.06	239.22*	241.66*	239.65*	241.82*	[illegible]
July	239.28*	240.24*	239.18*	239.6 *	239.65*	239.50*	[illegible]
August	239.18*	239.85*	239.16*	239.26*	239.13*	241.15*	[illegible]
September	241.08*	239.26*	239.02*	239.06*	238.95*	240.12*	[illegible]
October	240.50*	240.98*	239.01*	240.95*	238.85*	240.20*	[illegible]
November	241.43*	242.16	239.25*	240.91*	238.83*	242.06	[illegible]
December	242.26	240.96*	239.11*	239.05*	241.39*	241.45	[illegible]
Year	239.18*	239.26*	239.01*	239.05*	238.83*	239.50*	240.81*

Monthly Topographical Elevation of the Genesee River at the Johnson and Seymour Dam Rochester, N. Y.

MONTH.	1893. Mean elevation.	1894. Mean elevation.	1895. Mean elevation.	1896. Mean elevation.	1897. Mean elevation.	1898. Mean elevation.	1899. Mean elevation.
January	....	243.15	242.85	242.80	242.34	242.92	243.35
February	....	242.97	241.42*	243.12	242.50	243.37	242.45
March	243.54	244.22	243.66	243.70	244.09	243.81	243.41
April	243.27	244.12	243.59	244.59	243.12	243.09	243.34
May	243.15	245.50	242.23	242.09	242.68	242.82	242.34
June	240.80*	243.05	241.78*	242.14	241.20*	242.16	240.97*
July	239.95*	241.33*	240.28*	241.94	241.50*	240.70*	240.09*
August	239.67*	241.39*	240.80*	240.69*	239.64*	242.20	239.10*
September	242.12	241.86*	239.43*	239.51*	239.82*	241.08*	239.25*
October	241.81	241.85*	239.23*	242.59	239.22*	241.71*	239.51*
November	242.09	242.61	240.83*	242.06	240.69*	242.87	241.64*
December	243.44	242.22	241.53*	242.16	243.19	242.63	242.36
Year	241.98	242.85	241.38*	242.24	241.54*	242.45	241.67*

ST. LAWRENCE DRAINAGE BASIN.

St. Lawrence River receives the drainage from a number of important watersheds in northern New York. Its streams have their headwaters in the northwestern slope of the Adirondacks, where numerous lakes and ponds conserve a large portion of the naturally heavy precipitation.

There are five main streams, Oswegatchie, Grasse, Raquette, Salmon and Chateaugay rivers, which flow in a northwesterly direction in courses more or less parallel. Important waterfalls occur in several of these streams near the points where

* Elevation of water below crest of dam.

they emerge from the Adirondacks, and fall over ledges of gneiss, sandstone and granite onto the drift filled plains below.

Oswegatchie and Raquette Rivers are described in connection with gaugings on these streams. Grasse River drains a long, narrow watershed lying intermediate between Oswegatchie and Raquette Rivers. The channel of Grasse River is parallel to St. Lawrence River throughout the lower 18 miles of its course. For several miles of this distance it is separated from the St. Lawrence by a neck of land not exceeding four miles in width. Within this distance occurs the Long Sault rapids of St. Lawrence River, comprising a fall of 45 to 50 feet. This fact has been taken advantage of for the construction of a great hydraulic power plant by the St. Lawrence Power Company. A canal 3½ miles in length has been cut across the divide opposite Massena by which water is diverted from near the head of Long Sault Rapids to a power plant situated on the bank of Grasse River. Thirty-five thousand horse power is developed, under a head of 42 feet. The spent water is turned into Grasse River, which is used as a tail-race.[a]

Owing to its lack of storage, water power on Grasse River is of less importance than on its neighboring streams, Oswegatchie and Raquette Rivers. At Chase Mills a power exists, giving a fall of 8 feet, which, it is stated, could be increased to 30 feet by the construction of a suitable dam which would back water to the head of Chamberlain Rapids some distance upstream. Below Russell an undeveloped power exists, where, it is stated, a fall of 25 feet could be obtained.

Grasse River has a drainage area above Canton of 113 square miles, and of 637 square miles above its mouth. The stated high water marks at Chase Mills indicate a maximum discharge of 4,700 second-feet in the spring of 1897. The drainage areas of other streams tributary to St. Lawrence River are given below:

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[a] Full descriptions are given in Engineering News Feb. 21, 1901, pp. 130-132, and in a pamphlet "The St. Lawrence Power Company of Massena, New York," issued by the company.

STREAM.	Square miles.
West branch St. Regis River above junction of branches	280
East branch St. Regis River above junction of branches	347
St. Regis River below junction of two branches	627
Deer River above junction with St. Regis River	212
St. Regis River above mouth	910
Little Salmon River above junction with Salmon River	108
Salmon River above Malone	179
Salmon River above Little Salmon River	273
Salmon River below junction with Little Salmon River	452
Salmon River above mouth	490
Trout River above New York State line	129
Chateaugay River above New York State line	199

Principal Developed Water Powers on Grasse River.

No. of dam.	No. of mills at dam.	LOCATION.	Head in Feet. Greatest.	Least.	Average.	Number of employes.	Use made of power.
1	8	Massena	8	7½	8	8	Grist and planing mills.
2	2	Lewisville	9	5	7	6	Grist and saw mills.
3	1	Chase Mills	8	8	8	2	Custom saw mill.
4	5	Madrid	9	5	7	57	Clothing, feed and saw mills.
5	1	Bucks Bridge	9	8	8½	50	Saw mill.
6	4	Morley	8	3	6	8	Woodworking and feed mills.
7	4	Canton	12	6	9	......	Grist, saw mills, foundries, etc.
8	1	Canton	......	......	......	......	Saw mill.
9	1	Pyrites	......	......	65	......	Sulphite pulp mill.
10	2	Russell	10	6	8	8	Woodworking and grist mills.
		Water power on Little River.					
1	1	Little River	......	......	12	......	Saw mill.
2	1	Little River	......	......	14	3	Woodworking and grist mills.
3	1	Little River	......	......	14	......	Grist mill.
4	1	Little River	......	......	12	......	

OSWEGATCHIE RIVER.

This stream has its source in a region of lakes and timbered swamps in southern St. Lawrence county. The largest of the lakes is Cranberry Lake, which affords valuable storage to water power users on its outlet, East branch Oswegatchie River. The east and west branches flow in a general direction northwesterly. The two branches join near Taleville. From Gouverneur to Oxbow the river flows southwest. It then turns abruptly to the northeast. At Galilee it is joined by the outlet of Black Lake, and finally enters St. Lawrence River at Ogdensburg.

Fig. No. 38.—Oswegatchie River. Dam site at Wegatchie, St. Lawrence County, N. Y.

Fig. No. 39.—Oswegatchie River. Ogdensburg, St. Lawrence County, N. Y.

Drainage Area of Oswegatchie River.

LOCATION.	Square miles.
East branch Oswegatchie River above mouth	358
West branch Oswegatchie River above mouth	272
Oswegatchie River below junction of two branches	630
Oswegatchie River above Gouverneur	727
Oswegatchie River above Galilee	1,033
Indian River above Philadelphia	216
Black lake watershed above Galilee	544
Oswegatchie River below Black Lake junction	1,577
Oswegatchie River above Ogdensburg	1,609

Cranberry Lake has a water surface area of 12.8 square miles. Storage is developed by a federation of the water power users below. Black Lake, having a water surface area of 17.2 square miles, aids to regulate the flow at Ogdensburg. Opportunity for storage are presented on Indian River by Indian and Bonaparte Lakes. Storage is maintained on Lake Bonaparte as a private enterprise, water power users below paying for the use of the water during the dry season.

The first water power on the stream is at Ogdensburg. The dam is of timber, originally constructed in 1796. With the exception of the Ogdensburg city pumping station on the right bank, power is transmitted to the mill through an open hydraulic canal. The power is partitioned into 101 privileges, of which 26 are termed first-class and 75 second-class. Of these, 62 are in use, this number including all the first-class privileges. In 1872, the Supreme Court was called upon to define the rights of the several claimants. A system of weirs with movable crests was established. One being placed at the entrance to each penstock. Over these weirs the water must pass in order to reach the turbines. The head is never allowed to go below 8 feet. During low-water, excessive draught is prevented by raising the weirs. The crests of the weirs for second-class privileges are kept 1.5 feet above those for first-class. A standard form of weir is used for all privileges, the weirs having a crest length of 4 feet.

One first-class privilege is accepted as being 32 second-feet under the existing head, or 29 horse-power theoretical, under

the minimum head of 8 feet. The total power provided for is 754 theoretical horse-power. This would require a minimum flow of the stream of 928 second-feet.

The maximum reported high-water of Oswegatchie River at Ogdensburg dam, produced a depth of 5.5 feet on the crest of the dam, corresponding to an estimated discharge of 15,500 second-feet or 9.6 second-feet per square mile.

At Heuvelton, above Black Lake inlet, the estimated discharge from the reported high-water marks is 9,019 second-feet or 9.7 second-feet per square mile.

A current meter measurement of the low-water flow of Oswegatchie River at Eel Weir Bridge, 6 miles above Ogdensburg was made September 25, 1900; the discharge was found to be 614 second-feet, or 0.4 second-feet per square mile. At Heuvelton the measured discharge on September 26, 1900, was 804 second-feet or 0.8 second-feet per square mile from the tributary drainage area of 1,027 square miles.

The discharge of Indian River at Town Line Bridge, above Philadelphia, was 28.5 second-feet on September 28, 1900. On East branch Oswegatchie River, above Oswegatchie, are three undeveloped powers, capable of affording falls of 60, 20, and 20 feet respectively, by the construction of low diverting dams on their crests.

Six miles above Harrisville, on Middle Branch Oswegatchie River, occurs a series of seven or eight falls, including Jerden and Kilburn Falls. Among these is Sluice Falls, where the stream goes around an abrupt headland in a narrow channel, having a nearly precipitous descent of about 100 feet.

At Rensselaer Falls, Oswegatchie and Grasse Rivers are separated by a low lying swampy plain, draining in both directions through a so-called "natural canal."

Most of the powers of the Lower Oswegatchie watershed have been developed by the construction of timber dams on the crests of natural rifts, and there is very little opportunity for increasing the power except by centralizing the plants in single stations and installing more modern and highly efficient turbines.

Fig. No. 40.—Oswegatchie River, East Branch: At Newton Falls, St. Lawrence County, N. Y.

Fig. No. 41.—Raquette River Gauging-station: Dam of Electric Power Company at Hannawa Falls, St. Lawrence County, N. Y.

At Gouverneur a natural fall of 3 feet over rocks has been increased to 8 feet by the construction of a dam. The mills are distributed in a row across the stream channel; each apparently being intended by the original partitioner to have the use of so much water as flowed over the section of the stream channel he occupies. Above Gouverneur the power is chiefly utilized for the pulverization of talc in the production of mineral fibre.[a]

At Theresa, on Indian River, power is developed under a head of 20 feet, capable of increase to 35 feet; similarly, at Philadelphia, on the same stream, the existing head of 27.5 feet is capable of increase to 40 feet.

Principal Developed Water Powers on the Oswegatchie River.

					r.	Number of employes.	Use made of power.
1	17	Ogdensburg	13	4	8	[illegible]	General manufacturing.
2	9	Heuvelton	6	8	8	5	Wood working and grist mill.
3	3	Rensselaer Falls	3	7	7½	21	Saw mills and custom mills.
4	1	Coopers Falls	....	....	6	......	Saw mill privileges.
5	4	Wegatchie	....	...	11	......	Abandoned woolen mill. Saw mill; runs in winter.
6	1	Natural Dam	....	....	19½	[illegible]	Saw and paper mills.
7	7	Gouverneur	9	4	7	[illegible]	General manufacturing.
8	1	Hailsboro	....	....	......	......	Talc pulp.
9	1	Hailsboro	....	....	......	......	Talc pulp.
10	2	Hailsboro	....	....	13	4	Wood-working mills. Custom grinding.
11	1	Hailsboro	....	....	18	......	Talc pulp.
12	1	Hailsboro	....	....	20	1	Oswegatchie Light and Power Co.
13	1	Emeryville	....	....	31	[illegible]	Gouverneur Wood Pulp Co.
14	1	Dodgeville	....	....	16	11	U. S. Talc and Pulp Co.
15	1	Talcville	....	....	13	1	Talc mine.
16	3	Edwards	....	....	13	10	Grist and saw mills.
17	....	South Edwards	....	....	......	......	......
18	1	Fine	....	....	......	......	Saw and paper mills.
19	1	Oswegatchie	38	30	34	......	Standard Pulp Co.
20	1	Newton Falls	....	....	20	150	Wood pulp.
21	1	Newton Falls	....	....	36		Wood pulp paper.

Water Power on the West Branch.

1	1	Below Fullerville	....	....		5	Talc pulp.
2	1	Fullerville	....	....	18	......	Iron works (abandoned).
3	1	Fullerville	....	....	13	20	Wood and talc pulp.
4	1	Gears Corners	10	8	19¼	......	Saw mill (abandoned).
5	1	Harrisville	....	....	9 18	3	Grist mill.

RAQUETTE RIVER.

Raquette River drains a long, narrow watershed extending from northern Hamilton county to St. Lawrence River. Above Piercefield the drainage basin broadens out, including a region interspersed with lakes and ponds and affording ample opportunities for storage development,[b] as shown by the following list of lakes:

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[a] See The Talc Industry of St. Lawrence County, C. H. Smyth, Jr., in Report N. Y. State Museum 1895; pt. 11, pp. 661–671.

[b] Described in Report on A Survey of Upper Hudson and Raquette rivers, Farrand N. Benedict, 1872.

LAKE.	Surface area, square miles.	Drainage area, square miles.
Blue Mountain Lake *a*	3.9	39.24
Raquette Lake	8.8	98.9
Forked Lake	2.5	39.8
Long Lake	4.7	172.2
Little Tupper Lake	8.0	60.3

The upper plateau of Raquette River watershed is comparatively flat. Where the outflowing stream reaches the outcrop of granitic gneiss, forming the northwestern boundary line of the Adirondack region, it wears its way downward very slowly. From above Colton Falls to Hannawa Falls, a distance of 5 miles, a total fall of 385 feet occurs. With the exception of an old mill at its head, the upper portion of this fall is undeveloped.

Much of the fall occurs in passing a deep, narrow gorge mostly in Potsdam sandstone, affording both excellent sites and materials for dams. The most rapid descent is at Colton, where a fall of 100 feet occurs in a series of short cascades.

Going upstream, there are additional opportunities for power development at Higley Falls, South Colton Falls, and at Rainbow, Gaintwist, Leonard, Starks, Carry and Raquette Falls. These latter are in the heart of the timbered region of the Adirondacks and, lacking railroad facilities, are of little present importance. At Piercefield Falls, where the stream is crossed by the Adirondack Division of the N. Y. C. and H. R. R. R., is an important power development in connection with lumber industries.

Drainage Areas of Raquette River.

LOCATION.	Square miles.
Above Piercefield	695
Above Hannawa Falls	967
Above Massena Springs	1,186
Above mouth	1,260

In connection with the development of water power at the lower descent of 84 feet at Hannawa Falls, a gauging record has been established to determine the total flow of the stream past

a Including Eagle and Utowana Lakes.

Fig. No. 42.—Raquette River. Higley Falls above Colton, St. Lawrence County, N. Y.

Fig. No. 43.—Raquette River. Upper Falls at Colton, St. Lawrence County, N. Y.

the dam and power plant. The dam is constructed of Potsdam red sandstone, with an ogee shaped cross section. The length of the crest of the overflow is 234.5 feet. Water is carried along the top of the bluff at the right of the dam through an open earth canal 2,700 feet in length. The power canal terminates in a forebay from which the water is conducted to the turbines in the power house, at the foot of the cliff, through 6-foot steel penstocks. The turbines are a specially built wheel of the Samson type, constructed by James Leffel and Company of Springfield, Ohio; two runners being placed horizontally on the same shaft. The records kept for determining the volume of flow include, depth flowing over spillway, the discharge through waste gates, and the water used to drive the turbines.

The pond formed by the dam affords a storage surface of about 200 acres.[a]

A current meter measurement was made at Potsdam, N. Y., by Wallace C. Johnston on August 28, 1898, which probably showed the extreme low-water flow for that year, which was 755 second-feet.

A current meter measurement at Massena Springs Highway bridge October 2-3, 1900, showed the low water flow of Raquette River at that time to be 934 second-feet, or 0.78 second-foot per square mile.

Water power is being developed on Lower Raquette River at Norfolk, by carrying water around existing dams over a long rapid, so as to obtain a total fall of 32 feet. The power obtained will be used in the manufacture of paper. At Norwood a power exists where 8 foot head is now obtained, which could be re-developed so as to afford a total fall of 25 feet with extensive pond storage.

LAKE CHAMPLAIN OUTLET AT FORT MONTGOMERY, CLINTON COUNTY, N. Y.

Lake Champlain drains an area of 7,750 square miles, of which the major portion lies in the State of New York. The center line of the lake forms the boundary between New York and Vermont. The foot of the lake is situated at Rouse's Point, near the Canadian boundary line. Richelieu River, the outlet of the lake, is 75 miles in length. It flows northerly across the Prov-

[a] This plant is described in Engineering Record, Dec. 7, 1901, pp. 546-549.

line of Quebec and enters St. Lawrence river at Sorel. The lake has a water surface area of 437 square miles. It receives the drainage from the northeast slope of the Adirondacks. The principal tributary streams in New York are Chazy, Saranac and Ausable rivers. A record of the elevation of lake surface at Rouse's Point has been kept by the U. S. Corps of Engineers at Fort Montgomery, beginning with 187[illegible].

In 1896 the construction of the dam and power plant at Chambly was begun for the Royal Electric Company of Montreal.[a] The dam is of concrete masonry, strengthened with imbedded bent iron bars. It has an ogee cross section, a vertical upstream face, and a crest 6 feet wide, sloping downward from the lip to the upstream edge 2 inches per foot. The height of the dam from apron to crest is 18 feet, and it affords a fall of 28 feet at the power-house. A calibration curve of Richelieu River was calculated by the United States Board of Engineers on Deep Waterways, by comparing the computed discharge over this dam with the corresponding stage of Lake Champlain at Fort Montgomery, taking into consideration the slope of Richelieu River in the intervening distance of 35 miles from Rouse's Point to Chambly. From this curve the discharge in second-feet, corresponding to the observed stages of Lake Champlain at Fort Montgomery, has been deduced.[b]

Elevation of Lake Champlain at Fort Montgomery, N. Y.	Discharge of Richelieu River at Chambly, P. Q.
Feet.	*Second-feet.*
94	5,000
95	8,500
96	12,000
97	15,500
98	19,500
99	24,000
100	29,500
101	35,000

a Described in Engineering Record, June 17, 1899; pp. 59-61.

b Report of U. S. Board of Engineers on Deep Waterways, pt. 1, pp. 321-[illegible].

Mean Daily Discharge in Second-feet of Richelieu River at Chambly, P. Q.

[Drainage area, 7,750 square miles.]

Mean Daily Discharge in Second-feet of Richelieu River at Chambly, P. Q.—(Concluded).

Mean Monthly Run-off of Lake Champlain Drainage Basin at Chambly, P. Q.

[Drainage area, 7,750 square miles.]

IN SECOND FEET.

	1899.	1900.	1901.
January	10,630	10,900	11,[illegible]
February	9,618	14,510	9,[illegible]
March	13,321	16,046	10,533
April	21,675	27,342	20,6[illegible]
May	24,565	18,060	25,433
June	13,903	18,786	20,9[illegible]
July	9,839	12,014	13,[illegible]
August	6,877	9,300	10,[illegible]
September	5,174	7,170	7,6[illegible]
October	4,331	6,[illegible]	6,[illegible]
November	8,960	8,087	6,0[illegible]
December	11,439	13,327	10,463

SECOND-FEET PER SQUARE MILE.

	1899.	1900.	1901.
January	1.37	1.41	1.[illegible]
February	1.25	1.87	1 [illegible]
March	1.68	2.06	1 [illegible]
April	2.80	3.53	2.[illegible]
May	3.17	2.33	3.[illegible]
June	1.79	2.42	2 70
July	1.27	1.54	1 [illegible]
August	.89	1.20	1.30
September	.67	.93	.[illegible]
October	.56	.85	.[illegible]
November	1.15	1.04	.78
December	1.47	1 72	1.[illegible]

Mean Monthly Run-off of Lake Champlain Drainage Basin at Chambly, P. Q.—(Concluded).

INCHES ON DRAINAGE AREA.

	1899.	1900.	1901.
January	1.68	1.63	1.76
February	1.80	1.94	1.33
March	1.67	2.37	1.53
April	3.14	3.30	4.43
May	3.65	3.67	4.21
June	2.00	2.78	3.09
July	1.44	1.77	1.33
August	1.06	1.30	1.36
September	.75	1.03	1.10
October	.67	.98	.94
November	1.29	1.16	.87
December	1.69	1.98	1.55

Mean Monthly Run-off of Lake Champlain at Chambly, P. Q., in Second-feet.

[Drainage area, 7,750 square miles.]

Mean Monthly Run-off of Lake Champlain at Chambly, P. Q.

In Second-feet per Square Mile.

[Drainage area, 7,750 square miles.]

YEAR.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	[illegible]
1875	[illegible]	.76	[illegible]	2.4[illegible]	2.7[illegible]	2.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2.[illegible]	2.[illegible]	[illegible]	2.[illegible]	[illegible]	[illegible]	[illegible]	—	.76	[illegible]	[illegible]
[illegible]	.62	[illegible]	[illegible]	2.44	2.22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	1.55	2.45	2.28	[illegible]	[illegible]	[illegible]	1.64	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	2.50	3.62	2.16	[illegible]	[illegible]	.56	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2.16	[illegible]	2.38	[illegible]	[illegible]	[illegible]	[illegible]	.65	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.62	[illegible]	[illegible]	[illegible]	.54	.70	.89	[illegible]	[illegible]
[illegible]	1.59	1.65	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.95	.95	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	.64	[illegible]	[illegible]	[illegible]	[illegible]	1.74	1.25	[illegible]	[illegible]	[illegible]	.63	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	1.36	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.64	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	2.53	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	2.95	[illegible]	[illegible]	[illegible]	[illegible]	.90	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	1.69	[illegible]	[illegible]	2.52	[illegible]	[illegible]	.95	.65	.64	1.35	[illegible]
[illegible]	[illegible]	[illegible]	1.66	[illegible]	[illegible]	2.54	1.64	[illegible]	[illegible]	[illegible]	[illegible]	2.09	[illegible]
[illegible]	2.45	[illegible]	[illegible]	[illegible]	[illegible]	2.36	[illegible]	1.06	1.34	[illegible]	1.55	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2.43	2.66	[illegible]	2.99	[illegible]	1.25	1.35	[illegible]	1.53	[illegible]	[illegible]
[illegible]	1.64	[illegible]	[illegible]	3.69	[illegible]	1.53	[illegible]	[illegible]	.94	.70	[illegible]	.64	[illegible]
[illegible]	1.71	1.64	1.46	2.36	2.21	2.46	[illegible]	2.47	[illegible]	1.38	[illegible]	1.42	[illegible]
[illegible]	[illegible]	[illegible]	1.25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.32	1.10	.55	.56	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	2.25	1.92	1.65	[illegible]	[illegible]	.65	.67	.89	.92	[illegible]
[illegible]	[illegible]	.95	.95	[illegible]	[illegible]	1.53	[illegible]	[illegible]	.95	[illegible]	.85	[illegible]	[illegible]
[illegible]	[illegible]	1.52	2.32	[illegible]	[illegible]	1.52	1.53	1.32	[illegible]	.54	[illegible]	1.55	[illegible]
[illegible]	[illegible]	1.32	[illegible]	2.79	[illegible]	2.53	[illegible]	[illegible]	1.59	[illegible]	1.36	1.89	[illegible]
1898	1.56	1.92	2.56	[illegible]	[illegible]	[illegible]	1.36	.55	.54	[illegible]	1.33	[illegible]	[illegible]
Mean	1.42	1.44	1.75	2.62	2.94	2.20	1.58	1.23	1.05	.95	1.25	1.28	[illegible]

Mean Monthly Run-off of Lake Champlain at Chambly, P. Q.

In inches on drainage area.

[Drainage area, 7,750 square miles.]

YEAR.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1875	.56	.79	1.29	2.73	3.29	2.90	1.74	1.42	1.19	1.29	1.73	[illegible]
[illegible]	2.14	1.92	2.39	3.25	4.51	2.99	2.16	1.39	1.29	.99	.53	[illegible]
[illegible]	.72	[illegible]	1.23	2.76	2.55	1.69	1.62	1.49	1.34	1.30	1.34	[illegible]
[illegible]	1.54	1.16	[illegible]	2.79	3.16	1.99	1.45	1.94	1.54	1.25	1.34	[illegible]
[illegible]	[illegible]	1.71	2.15	2.90	[illegible]	2.49	1.75	1.32	.59	.53	.99	[illegible]
[illegible]	1.60	1.95	2.36	2.45	2.55	1.65	1.36	.93	.64	.56	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	2.54	[illegible]	2.09	1.45	1.15	.94	.67	[illegible]	[illegible]
[illegible]	1.79	1.54	2.50	[illegible]	[illegible]	2.49	2.16	1.44	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	.67	[illegible]	2.56	3.23	2.55	2.30	1.44	.91	.70	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2.27	[illegible]	3.67	2.53	1.55	1.82	.96	.73	[illegible]	[illegible]
[illegible]	1.69	1.50	1.47	2.53	[illegible]	[illegible]	1.72	1.43	1.40	.99	2.43	[illegible]
[illegible]	2.52	[illegible]	2.25	3.30	[illegible]	[illegible]	1.53	1.20	.90	.92	[illegible]	[illegible]
[illegible]	1.59	[illegible]	1.94	[illegible]	[illegible]	2.52	1.99	1.67	1.76	.75	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	3.43	4.49	2.54	[illegible]	1.57	1.45	[illegible]	[illegible]	[illegible]
[illegible]	2.96	2.14	[illegible]	[illegible]	[illegible]	2.55	[illegible]	[illegible]	1.39	1.69	[illegible]	[illegible]
[illegible]	[illegible]	2.14	2.79	[illegible]	[illegible]	3.55	[illegible]	1.44	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	2.18	3.50	4.13	3.45	[illegible]	1.47	1.22	1.35	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	1.60	[illegible]	[illegible]	2.76	3.54	2.77	[illegible]	1.54	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	1.44	2.56	[illegible]	[illegible]	1.44	1.28	[illegible]	1.26	.95	[illegible]
[illegible]	1.47	[illegible]	2.39	[illegible]	[illegible]	1.55	1.44	1.42	.76	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	.99	[illegible]	2.54	[illegible]	[illegible]	1.39	1.18	1.04	[illegible]	.96	[illegible]
[illegible]	[illegible]	[illegible]	2.57	[illegible]	[illegible]	2.14	1.55	[illegible]	.95	.97	[illegible]	[illegible]
[illegible]	1.23	[illegible]	1.56	[illegible]	[illegible]	[illegible]	2.96	2.73	1.75	1.35	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	3.39	3.54	2.76	1.99	1.45	1.09	.94	1.29	1.49	[illegible]
Mean	1.62	1.50	2.05	3.60	3.27	2.35	1.53	1.47	1.22	1.09	1.29	[illegible]

MOHAWK RIVER GAUGINGS.

Despite its importance as a source of power and as an avenue of commerce, very little was known as to the water-yielding capacity of Mohawk River, prior to the investigations of the

Fig. No. 44.—Mohawk River: Gauging Station at Gilbert's Dam, Little Falls, Herkimer County, N. Y.

United States Board of Engineers on Deep Waterways. The results of gaugings of the discharge of the stream over dams at Ridge Mills, Little Falls, Rocky Rift, Rexford Flats, and Dunsbach Ferry, are given below. Gauging records have also been maintained at a current meter station near Schenectady, and for the determination of the discharge by the slope formula at a number of points. At present there are available simultaneous records for the high water period of 1901 on the lower Mohawk, obtained by three distinct methods; the weir formula, the current meter, and the slope formula.

The regimen of the Mohawk River during the navigation season is undoubtedly modified to a large extent by the influence of the Erie Canal, by which the river is paralleled from Rome to Cohoes, a distance of 110 miles. The water supply of the Erie Canal, east of the summit level at Rome is, with a single exception, derived from Mohawk River and its trubutaries. At Rome, water enters the watershed which has been brought from adjacent drainage areas feeding the western end of the summit level. In addition, water from Black River watershed is brought in through Black River Canal.

New York State Dams and Canal Feeders in Mohawk Valley.

STREAM.	Location.
Mohawk River	Delta, six miles above Rome, Oneida county, N. Y.
Mohawk River	Rome, Oneida county, N. Y.
Oriskany Creek	Oriskany, Oneida county, N. Y.
Mohawk River	Little Falls, Herkimer county, N. Y.
Mohawk River	Five Mile or Rocky Rift Dam, Herkimer county, N Y.
Schoharie Creek	Fort Hunter, Montgomery county, N. Y.
Mohawk River	Rexford Flats, Saratoga county, N. Y.

A large diversion from the watersheds of these feeders is in some measure counterbalanced by return water to the main stream channel from seepage through canal and feeder banks and flow over waste-weirs.

The complex character of the run-off of the Upper Mohawk River is shown by the following current meter measurements which were made on August 18, 1901, at a time when no canal

boats were passing, so that the level of water in each case remained statical during the measurements.

Flow from Mohawk River into Delta feeder..	48.8 second-feet
Flow in Mohawk River at bridge, one mile below feeder	145.2 second-feet
Total flow of Mohawk River at Delta....	194.0 second-feet
Flow in Black River Canal below Delta.....	130.1 second-feet
Diversion from Mohawk as above...........	48.8 second-feet
Diversion into Mohawk Valley through Black River Canal above Delta........	81.3 second-feet

This does not take into consideration diversion or return waters from Lansingkill which parallels Black River Canal above Delta.

August 31, 1900, the diversion to Erie Canal at Rome feeder was found by current meter measurement to be 150 second-feet. The flow in the stream channel below the dam on the same date was 38 second-feet. Total flow at Rome 188 second-feet. Similar measurements August 18, 1901 showed the diversion to the canal at Rome feeder to be 146 second-feet, the estimated waste over the State dam was 35 second-feet, the total flow at Rome being 181 second-feet.

Measurements of the flow in Forestport feeder of Black River Canal were made in connection with the Barge Canal Survey in 1900.*

The column in the following table, showing flow in canal south of feeder, represents the inflow from Black River watershed to Mohawk River watershed on the dates named.

DATE.	Observed discharge of feeder, second-feet.	Flow in canal south of feeder, second-feet.	Observed flow over waste-weir, second-feet.	Observed flow in [illegible] of feeder, second-feet.
1900.				
August [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
September [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
November [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
December [illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*See State Engineer Bond's "Report on Barge Canal, 1901," p. [illegible], in report of "Engineer for Water Supply."

The gauging records at Rexford Flats and at Little Falls indicate that the yield of the watershed in second-feet per square mile, and frequently, also, the actual flow in second-feet, is considerably less during the navigation season at the former than at the latter station. The drainage area above Rexford Flats is 3,385 square miles, or 2.6 times that at Little Falls, which is 1,306 square miles. The diminished water-yielding capacity of the lower Mohawk basin may be attributed in part to the low water of Schoharie Creek. The drainage area of Schoharie Creek is 947 square miles. Weir measurements at Schoharie Falls show that the flow sometimes falls below 50 second-feet. During practically the entire summer no water flows over the crest of the State dam at Fort Hunter. The major portion of the flow is diverted to the Erie Canal feeder and the remainder leaks through the dam. During the summer of 1900, from June to October, inclusive, the direct inflow to the Mohawk from this tributary did not, with the exception of a few days, exceed 45 second-feet or 0.05 second-feet per square mile.

MOHAWK RIVER AT RIDGE MILLS, ONEIDA COUNTY, N. Y.

Mohawk River rises in Lewis County and flows southerly from Oneida County to Rome where it turns to the east and finally empties into Hudson River at Cohoes. It is shown through the greater portion of its length on the Oneida, Oriskany, Utica, Little Falls, Canajoharie, Fonda, Amsterdam, Schenectady, and Cohoes topographic sheets of the United States Geological Survey.

The greatest fall occurs at the mouth of the stream at Cohoes, where there is a descent of 105 feet over Hudson River shale; extensive water power development being carried out through the construction of a long headrace from which the water is drawn off into lateral canals, utilizing the total fall in five different levels. From Cohoes to Little Falls, the stream valley is broad, with moderate side slopes and the course of the stream

[illegible] A barrier of rock [illegible] the valley at Little Falls, where a gorge has been formed with sides [illegible] feet high [illegible] through which the stream descends [illegible] feet. Above Little Falls to a point near Rome the stream is [illegible] and [illegible], winding through a flat valley or flood-plain which is [illegible] during high water.

The gaging station at Ridge Mills is located at the dam of the Rome city water-works three miles above Rome. The dam is of rough timber, with plank facing, having a slightly irregular crest 122 feet in length, which is divided into several sections, each assumed to be level to facilitate discharge computations. During the year 1900 the calculated discharge of the turbines has been made to depend on current meter measurements instead of on the observed wheel gate openings as formerly. The pump house, adjacent to the dam, contains two [illegible]-inch Hercules turbines. The discharge through these is sensibly proportional to the rate at which the water-work pumps, which they drive, are run. A straight line diagram has been prepared, using the following data, from which the flow through the turbines has been taken.

DATE.	Speed of pumps, revolutions per minute.	Measured flow in tail-race, second-feet.
May 25, 1900	15	122
August 24, 1900	12	95

Mean Monthly Run-Off of Mohawk River at Ridge Mills, N. Y.

[Drainage area, 153 square miles.]

MONTH.	SECOND-FEET.			SECOND-FEET PER SQUARE MILE.			INCHES OF DRAINAGE AREA.		
	1898.	1899.	1900.	1898.	1899.	1900.	1898.	1899.	1900.
January	....	377	160	....	2.46	1.04	....	2.83	1.20
February	....	244	531	....	1.59	3.49	....	1.65	3.55
March	....	467	336	....	3.05	2.19	....	3.15	2.53
April	....	997	1,062	....	6.52	6.94	....	7.27	7.74
May	....	320	126	....	2.09	0.82	....	2.41	0.95
June	....	231	150	....	1.54	1.17	....	2.05	1.30
July	....	310	160	....	2.02	1.04	....	2.33	1.20
August	....	226	140	....	1.48	0.92	....	1.70	1.06
September	....	81	195	....	0.53	1.30	....	0.59	1.45
October	260	278	212	2.41	1.81	1.39	2.78	2.08	1.60
November	401	291	971	2.62	1.90	....	2.92	2.12	....
December	261	532	....	1.40	3.47	....	1.61	4.00	....
Year	....	....	....	....	....	....	....	32.18	....

Mean Daily Flow in Second-Feet of Mohawk River at Ridge Mills, N. Y.

[Drainage area, 153 square miles.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	cOct.	cNov	cDec.
1898.												
1	......	......	......	......	......	......	......	......	......	154	269	123
2	......	......	......	......	......	......	......	......	......	149	249	144
3	......	......	......	......	......	......	......	......	......	133	215	133
4	......	......	......	......	......	......	......	......	......	127	199	133
5	......	......	......	......	......	......	......	......	......	148	215	169
6	......	......	......	......	......	......	......	......	......	249	249	184
7	......	......	......	......	......	......	......	......	......	199	369	144
8	......	......	......	......	......	......	......	......	......	178	259	169
9	......	......	......	......	......	......	......	......	......	159	249	169
10	......	......	......	......	......	......	......	......	......	149	1,134	154
11	......	......	......	......	......	......	......	......	......	143	2,134	184
12	......	......	......	......	......	......	......	......	......	149	697	184
13	......	......	......	......	......	......	......	......	......	154	515	121
14	......	......	......	......	......	......	......	......	......	259	439	135
15	......	......	......	......	......	......	......	......	......	359	371	159
16	......	......	......	......	......	......	......	......	......	349	359	159
17	......	......	......	......	......	......	......	......	......	319	315	154
18	......	......	......	......	......	......	......	......	......	215	294	169
19	......	......	......	......	......	......	......	......	......	199	294	144
20	......	......	......	......	......	......	......	......	......	249	304	159
21	......	......	......	......	......	......	......	......	......	215	279	342
22	......	......	......	......	......	......	......	......	......	999	369	609
23	......	......	......	......	......	......	......	......	......	559	697	974
24	......	......	......	......	......	......	......	......	......	794	409	639
25	......	......	......	......	......	......	......	......	......	519	294	419
26	......	......	......	......	......	......	......	......	......	609	215	344
27	......	......	......	......	......	......	......	......	......	1,251	191	319
28	......	......	......	......	......	......	......	......	......	574	199	159
29	......	......	......	......	......	......	......	......	......	409	134	219
30	......	......	......	......	......	......	......	......	......	339	104	324
31	......	......	......	......	......	......	......	......	......	314	......	644
Mean	......	......	......	......	......	......	......	......	......	369	401	261
1899.	c	c	c	c	c						*	*
1	316	214	351	364	321	339	262	218	......	93	615	225
2	243	214	394	319	319	319	252	233	......	208	515	695
3	296	214	366	254	239	279	232	248	......	233	345	395
4	298	214	301	311	204	259	249	131	......	253	295	345
5	2,373	199	1,176	344	176	214	202	146	......	200	365	295
6	396	164	1,074	391	151	232	127	131	......	310	295	295
7	409	123	735	439	102	232	262	126	......	290	265	275
8	316	166	414	1,244	94	262	322	121	......	260	295	235
9	299	126	316	1,084	129	259	669	125	85	290	295	235
10	219	129	219	696	138	279	499	129	85	310	245	285
11	184	129	254	799	344	249	379	139	85	340	315	315
12	157	129	1,174	1,364	414	282	359	169	95	260	295	3,625
13	157	129	1,211	1,492	296	282	339	265	89	310	265	1,155
14	153	173	701	2,181	561	302	339	245	85	240	265	510
15	911	265	364	1,741	214	402	319	275	99	310	265	455
16	725	258	321	1,341	161	399	399	295	115	240	265	365
17	459	184	239	1,364	389	359	319	230	135	220	295	295
18	324	126	219	1,654	361	339	399	240	112	290	295	295
19	224	166	274	2,224	549	282	332	245	85	290	265	1,075
20	199	151	561	2,034	614	279	339	245	79	290	245	1,495
21	193	160	464	1,404	436	262	302	265	79	240	245	1,095
22	208	494	364	1,264	319	259	382	295	56	260	265	315
23	214	697	389	1,189	274	299	299	272	56	260	265	313
24	261	8-9	436	959	239	259	292	289	56	310	265	345
25	338	346	416	766	219	259	275	262	60	340	295	315
26	318	296	344	614	204	259	262	260	69	220	265	285
27	244	336	274	549	189	249	259	309	69	310	265	285
28	223	451	241	439	386	249	165	309	58	340	265	285
29	208	......	581	354	1,136	249	183	278	58	360	205	285
30	170	......	436	319	516	229	178	315	79	260	205	75
31	170	......	436	......	344	......	178	200	......	260	......	75
Mean	377	244	467	997	320	281	310	226	81	278	291	532

c Revised. * Record doubtful.

Mean Daily Flow in Second-Feet of Mohawk River at Ridge Mills, N. Y.—Concluded.

[Drainage area, 153 square miles.]

DAY.	Jan. a	Feb.	Mar.	April.	May b	June b	July b	Aug. b	Sept. b	Oct. b	Nov.	Dec.
1900.												
1	[illegible]	200	704	[illegible]	231	165	225	204	235	175	385	......
2	[illegible]	232	675	1,09[illegible]	[illegible]	224	225	231	125	185	385	......
3	[illegible]	[illegible]	75[illegible]	[illegible]	[illegible]	285	315	22[illegible]	309	365	301	......
4	29[illegible]	[illegible]	63[illegible]	[illegible]	[illegible]	23[illegible]	[illegible]	92	365	[illegible]	301	......
5	[illegible]	[illegible]	259	[illegible]	23[illegible]	258	26[illegible]	91	122	225	468	......
6	[illegible]	245	224	1,265	[illegible]	165	256	205	122	225	1,975	......
7	[illegible]	225	354	2,275	[illegible]	275	775	64	122	225	965	......
8	[illegible]	725	356	1,541	[illegible]	[illegible]	275	94	314	[illegible]	835	......
9	475	1,625	257	[illegible]	231	235	[illegible]	375	95	225	765	......
10	530	1,125	356	761	185	225	[illegible]	246	306	225	725	......
11	477	654	280	661	136	185	23[illegible]	88	306	225	725	......
12	420	725	279	957	125	186	256	154	307	225	64[illegible]	......
13	425	1,102	254	937	196	157	175	365	92	305	62[illegible]	......
14	395	1,125	254	555	136	275	236	452	95	322	645	......
15	307	1,154	279	947	116	165	336	364	225	385	585	......
16	265	415	164	1,495	[illegible]	155	306	88	225	385	386	......
17	245	579	149	1,665	2[illegible]	156	261	64	275	385	625	......
18	345	254	159	3,575	2[illegible]	156	207	80	325	305	606	......
19	365	242	189	1,965	147	165	164	64	225	96	1,556	......
20	1,965	255	544	955	167	175	165	92	279	96	1,780	......
21	1,155	156	597	937	135	175	257	95	625	95	1,490	......
22	675	255	561	1,275	13[illegible]	165	155	224	625	95	965	......
23	655	402	564	937	112	155	125	97	415	95	965	......
24	245	774	576	675	126	265	132	84	435	885	735	......
25	365	285	164	555	136	140	575	165	385	415	1,065	......
26	499	172	160	365	125	145	27[illegible]	165	285	385	1,990	......
27	255	202	164	365	126	123	136	120	225	415	(c)	......
28	265	122	160	[illegible]	135	140	175	155	127	385	......	......
29	275	......	164	275	[illegible]	137	150	125	185	345	......	......
30	275	......	116	225	155	124	107	126	285	95	......	......
31	265	......	112	......	165	......	117	179	......	95	......	......
Mean	160	561	326	1,082	126	180	160	180	198	222	971	......

a Record doubtful; owing to ice on crest of dam.
b Record doubtful; flash-boards changed frequently.
c Dam and gauge injured in flood.

A measurement of the leakage of the dam was made in the stream channel below, August 23, 1900, when no water was flowing over the crest. The leakage was found to be 20 second-feet, and an allowance for this amount has been made in estimating the daily flow. A rough current meter measurement of the discharge at the bridge crossing the pond above the dam, April 22, 1900, showed the inflow to the pond to be 1,385 second-feet. August 31, 1900, the total flow of the stream at Riverside Park, one mile below the dam, was found to be 188 second-feet.

The gauging record at Ridge Mills does not include any allowance for diversion to Black River Canal at Delta feeder, four miles upstream, nor for return water from seepage and waste weirs. Water for the municipal supply of Rome is taken from Mohawk River at Ridge Mills, the amount of diversion averaging 2,500,000 gallons per day, equivalent to a continuous flow of 4 second-feet. The dam was injured by the flood of November

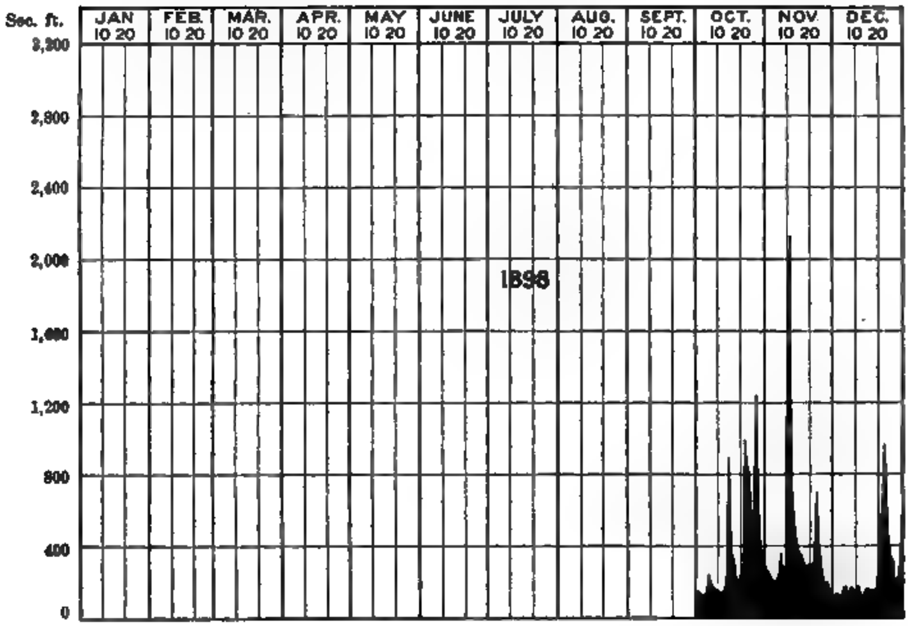


Fig. No. 45.—Discharge of Mohawk River at Ridge Mills, Oneida County, N. Y., 1898.

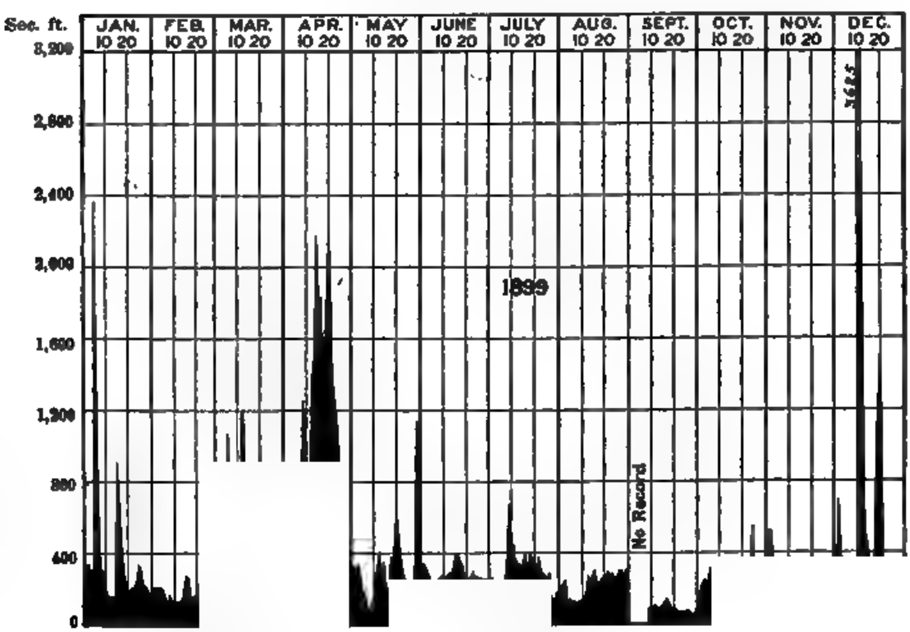


Fig. No. 46.—Discharge of Mohawk River at Ridge Mills, Oneida County, N. Y. 1899.

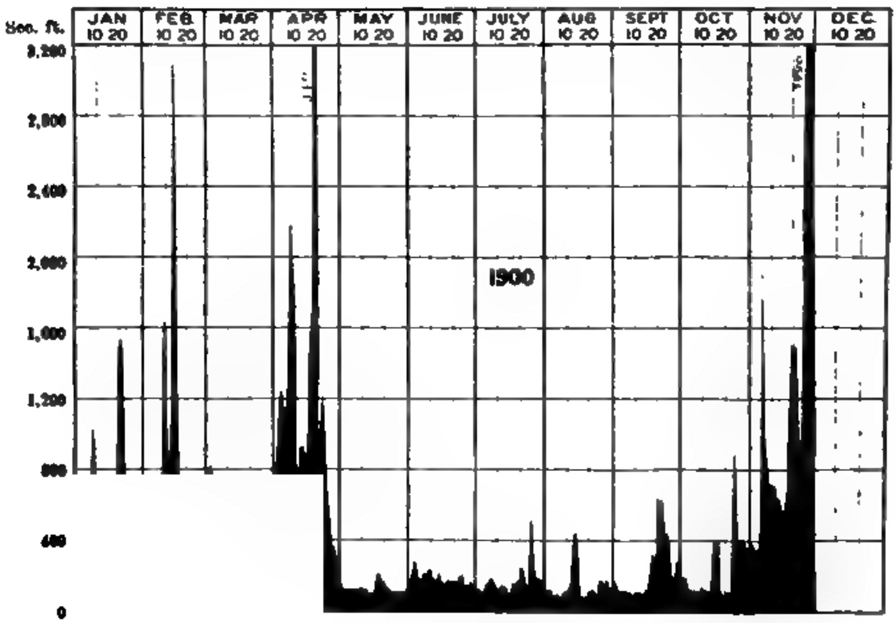


Fig. No. 47.—Discharge of Mohawk River at Ridge Mills, Oneida County, N. Y., 1900.

26, 1900, and the record discontinued. On November 26, 1900, the maximum calculated discharge of 4,940 second-feet occurred, corresponding to a flow of 32.3 second-feet per square mile of the tributary drainage area of 153 square miles. March 12, 1898, a discharge rate of 5,266 second-feet was obtained. This is equivalent to 34.5 second-feet per square mile. The highest previous freshet reported occurred in the spring of 1898, the calculated discharge being 7,080 second-feet or 46.4 second-feet per square mile. During extreme high water, some discharge takes place through overflow channels under the highway at the left of the dam. This has been included in the above estimates.

ORISKANY CREEK AT ORISKANY, ONEIDA COUNTY, N. Y.

This stream rises in Oneida county, N. Y., and flows in a northerly direction, emptying into the Mohawk River.

The location of this station, as well as that of a second station which was maintained for a time at Coleman on this stream are shown on the Oriskany atlas sheet of the United States Geological Survey.[a] The Oriskany station is located at the New York State Dam, which is of timber, having a crest 214 feet in length with a somewhat irregular profile, which, in order to facilitate computation, has been divided into three sections, each assumed to be level; its elevation being taken equal to the average elevation of this portion of the profile. The dam is low, the difference of elevation on the upstream and downstream sides ordinarily being about 4 feet. During extreme high water the dam becomes completely submerged. During the summer, the entire flow, less leakage, is ordinarily diverted to the canal feeder. H. Waterbury & Company's dam, located just below the State dam, backs water above the toe of the latter, so that direct measurements of the leakage of the State dam cannot readily be made.

During the winter and spring the flow of the stream is available for power from the lower dam, but during the season of

a See Water Supply and Irrigation Paper, U. S. Geol. Survey, No. 35, p. 47. The record kept at Coleman is described in Report U.S. Board of Engineers on Deep Waterways, 1900, pt. II, pp. 594–595.

navigation the inflow to the Mohawk from this tributary amounts to only a few second-feet. The computed flow at the gauging station represents the total outgo from the pond above the State dam, and includes water diverted from Chenango River through the channel of Oriskany Creek to feed the Erie Canal.

A record is kept of the height of water in the pond above the dam, and also in the feeder-channel below the head-gates. The observed difference, or head on the feeder-gates, together with the area of the gate openings, have been used in the formula for discharge through submerged orifices, to determine the flow. A screen rack in the forebay, just above the feeder-gates, often becomes clogged with drift, causing a loss of head of several inches. In order that the correct head on the feeder-gates might be obtained, a gauge was placed in the fore-bay, between the screen rack and feeder-gates, at the beginning of the navigation season of 1900.

During the dry season, the gateways, leading to the feeder, are wide opened, and the water flows through unobstructed, as in an open channel, so that the formula for orifices cannot be applied.

In this connection, the difficulties encountered in gauging the flow in canal feeders are worth comment. Broadly speaking, the amount of water required for the supply of canals is proportional to lockage and evaporation jointly, with perhaps a constant factor added for seepage losses. As a matter of fact, however, the rate of flow in the feeder often fluctuates within wide limits several times a day. Gates are usually placed in both the inlet and outlet ends of the feeder-channel. The stage or height of the water in the feeder is influenced by that of the water in the canal itself, as well as in the supply pond above, while the velocity of flow may be varied by changes in the gate opening at either end. Isolated discharge measurements are of value in a general way, but it may be said that nothing short of a continuous record, both of the stage of the water in the feeder and of its velocity of flow will serve to determine the actual diversion from day to day.

Mean Monthly Run-off of Oriskany Creek at Oriskany, N. Y.

[Drainage area, 144 square miles.]

	SECOND-FEET.			SECOND-FEET PER SQUARE MILE.			INCHES ON DRAINAGE AREA.		
	1898.	1899.	1900.	1898.	1899.	1900.	1898.	1899.	1900.
January	....	295	199	....	2.04	1.38	....	2.35	1.59
February	....	291	378	....	2.02	2.62	....	2.10	2.72
March	....	342	386	....	2.37	2.67	....	2.73	3.07
April	....	466	488	....	3.23	3.38	....	3.60	3.77
May	....	119	136	....	0.83	0.94	....	0.95	1.08
June	....	99	95	....	0.69	0.66	....	0.77	0.73
July	....	180	100	....	1.25	0.69	....	1.44	0.79
August	....	186	103	....	1.29	0.71	....	1.48	0.81
September	....	126	73	....	0.87	0.51	....	0.97	0.57
October	325	91	85	2.25	0.63	0.59	2.59	0.72	0.68
November	327	360	255	2.27	2.49	1.78	2.53	2.77	1.99
December	327	89	272	2.27	0.62	1.90	2.61	0.71	2.19

Mean Daily Flow in Second-feet of Oriskany Creek at Oriskany, Oneida County, N. Y.

[Drainage area, 144 square miles.]

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1898.												
1	......	......	......	......	......	......	......	......	......	......	329	266
2	......	......	......	......	......	......	......	......	......	......	298	259
3	......	......	......	......	......	......	......	......	......	......	274	428
4	......	......	......	......	......	......	......	......	......	......	276	413
5	......	......	......	......	......	......	......	......	......	......	266	457
6	......	......	......	......	......	......	......	......	......	......	269	445
7	......	......	......	......	......	......	......	......	......	......	267	445
8	......	......	......	......	......	......	......	......	......	......	236	462
9	......	......	......	......	......	......	......	......	......	......	284	393
10	......	......	......	......	......	......	......	......	......	......	370	388
11	......	......	......	......	......	......	......	......	......	......	740	425
12	......	......	......	......	......	......	......	......	......	......	370	460
13	......	......	......	......	......	......	......	......	......	......	365	346
14	......	......	......	......	......	......	......	......	......	......	333	160
15	......	......	......	......	......	......	......	......	......	......	352	150
16	......	......	......	......	......	......	......	......	......	338	311	300
17	......	......	......	......	......	......	......	......	......	248	304	280
18	......	......	......	......	......	......	......	......	......	212	304	160
19	......	......	......	......	......	......	......	......	......	231	310	220
20	......	......	......	......	......	......	......	......	......	266	392	195
21	......	......	......	......	......	......	......	......	......	248	359	300
22	......	......	......	......	......	......	......	......	......	328	263	390
23	......	......	......	......	......	......	......	......	......	350	300	325
24	......	......	......	......	......	......	......	......	......	316	324	410
25	......	......	......	......	......	......	......	......	......	280	278	355
26	......	......	......	......	......	......	......	......	......	330	258	210
27	......	......	......	......	......	......	......	......	......	564	502	150
28	......	......	......	......	......	......	......	......	......	457	335	100
29	......	......	......	......	......	......	......	......	......	408	309	285
30	......	......	......	......	......	......	......	......	......	339	254	235
31	......	......	......	......	......	......	......	......	......	336	......	285
Mean	......	......	......	......	......	......	......	......	......	325	327	327

Mean Daily Flow in Second-Feet of [illegible] Creek, at [illegible], [illegible] County, N. Y.—Concluded.

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
[illegible]												
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
26	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29	[illegible]	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
30	[illegible]	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
31	[illegible]	......	[illegible]	......	[illegible]	......	[illegible]	[illegible]	......	[illegible]	......	[illegible]
Mean	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1906												
1	84	139	224	1,128	228	95	[illegible]	200	82	78	285	250
2	132	272	796	[illegible]	132	95	[illegible]	[illegible]	74	79	297	285
3	[illegible]	224	176	[illegible]	143	95	[illegible]	[illegible]	75	78	136	265
4	96	254	774	546	158	95	[illegible]	[illegible]	84	78	127	173
5	[illegible]	414	784	626	144	95	[illegible]	[illegible]	86	79	122	467
6	74	902	884	[illegible]	152	95	140	[illegible]	[illegible]	78	73	465
7	54	[illegible]	734	494	[illegible]	95	88	[illegible]	95	75	95	330
8	[illegible]	902	424	596	153	97	73	[illegible]	85	[illegible]	97	265
9	56	[illegible]	384	[illegible]	136	95	274	[illegible]	67	86	105	285
10	114	504	902	274	133	95	[illegible]	[illegible]	73	65	95	177
11	74	414	[illegible]	[illegible]	152	95	177	[illegible]	73	75	155	288
12	94	[illegible]	143	254	[illegible]	95	126	207	67	75	157	147
13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	95	125	130	72	75	106	258
14	[illegible]	424	[illegible]	274	94	95	135	134	72	75	123	142
15	[illegible]	244	[illegible]	272	102	96	125	127	70	75	136	112
16	133	139	123	236	119	96	125	128	70	84	96	157
17	[illegible]	114	127	[illegible]	164	95	126	100	70	81	113	288
18	[illegible]	74	74	1,196	171	95	126	120	72	78	124	217
19	544	40	171	427	156	95	127	100	70	88	87	217
20	1,210	91	494	215	149	95	125	120	70	98	127	357
21	[illegible]	127	434	[illegible]	161	95	107	110	70	75	127	277
22	727	171	254	[illegible]	115	95	124	[illegible]	[illegible]	75	75	262
23	176	204	224	[illegible]	113	96	106	[illegible]	70	77	156	272
24	[illegible]	94	254	267	113	95	106	100	70	88	161	1,172
25	[illegible]	91	274	279	113	96	114	105	70	75	490	427
26	176	96	224	225	113	95	119	104	70	75	2,592	262
27	[illegible]	170	163	202	113	95	112	112	70	104	857	217
28	108	132	227	263	113	97	108	132	75	100	342	172
29	91	......	258	262	113	95	83	111	85	100	342	172
30	114	......	[illegible]	272	113	96	82	104	66	100	297	192
31	[illegible]	......	544	......	113	95	80	100	......	191	......	177
Mean	[illegible]	273	[illegible]	486	136	95	109	103	73	85	355	272

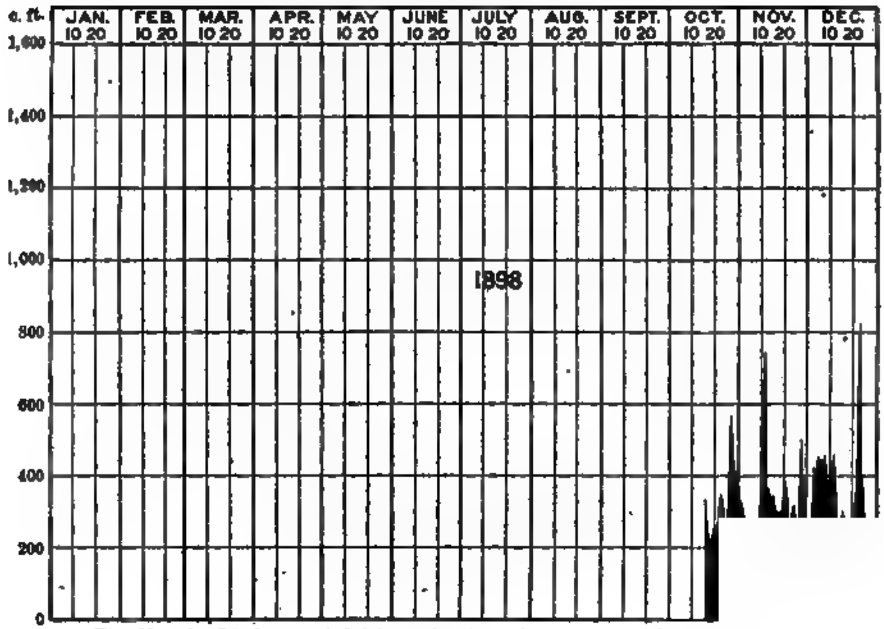


Fig. No. 48.—Discharge of Oriskany Creek at Oriskany, Oneida County, N. Y., 1898.

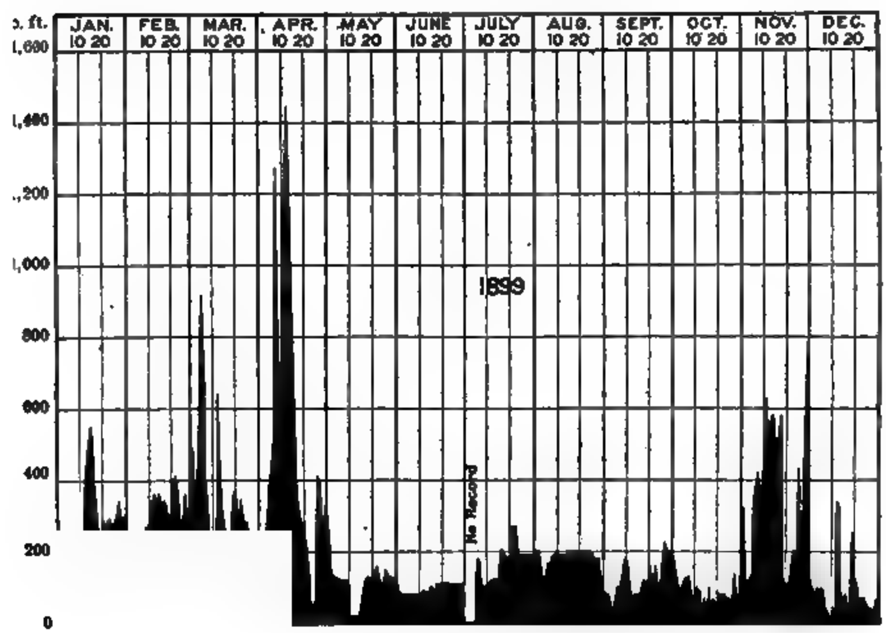


Fig. No. 49.—Discharge of Oriskany Creek at Oriskany, Oneida County, N. Y., 1899.

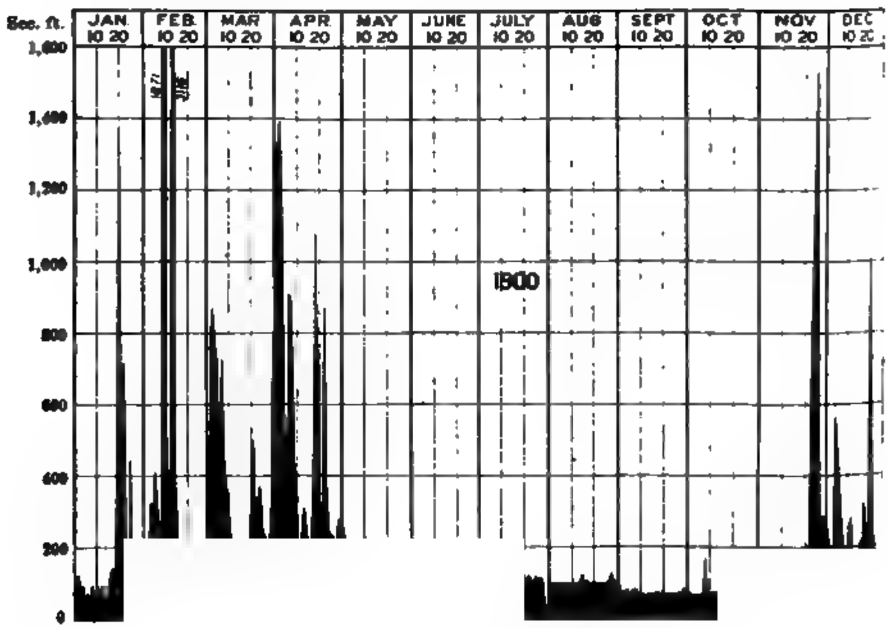


Fig. No. 50.—Discharge of Oriskany Creek at Oriskany, Oneida County, N. Y., 1900.

Current Meter Discharge Measurements of Oriskany Feeder.

DATE.	Discharge, second-feet.	Hydrographer.
October 13, 1898	77.94	W. D. Lockwood.
October 15, 1898	49.55	W. D. Lockwood.
October 15, 1898 *a*	118.89	W. D. Lockwood.
April 28, 1900	167.95	R. E. Horton.
May 29, 1900	103.20	R. E. Horton.
August 7, 1900	100.70	E. C. Murphy.
August 8, 1900	62.20	E. C. Murphy.
August 10, 1900	84.00	E. C. Murphy.
August 11, 1900	100.00	E. C. Murphy.
May 1, 1901	87.80	R. E. Horton.
May 1, 1901 *a*	109.60	R. E. Horton.
May 2, 1901	173.00	R. E. Horton.

April 30, 1900, the discharge from Oriskany Creek to Mohawk River was measured below H. Waterbury & Company's Mill, Oriskany, and found to be 84 second-feet.

ORISKANY CREEK AT WOOD ROAD BRIDGE, ORISKANY, ONEIDA COUNTY, N. Y.

Owing to difficulty of determining summer flow with precision, the original gauging station at the State dam in Oriskany was abandoned January 31, 1901.[b] This station was replaced on June 26, 1901, by a current meter gauging station at Wood's Road Bridge one-half mile farther upstream. The location of this station may be seen on the Oriskany sheet of the topographic atlas of the United States Geological Survey. An 8.5 foot standard cypress gauge board, divided to feet and tenths and set in a vertical position, was attached to the upstream side of the right-hand abutment of the bridge, from which readings of the stage of the stream are taken twice daily by the gauge reader, Charles W. Smith. The bridge stands squarely across the channel, has vertical masonry abutments and a span of 80 feet. The bench mark is situated on the northwest corner of the upstream side of the bridge seat, on the right-hand abutment.

Elevation of bench mark	100.00
Elevation of gauge zero	86.34

a Second measurement made after a change in feeder gate openings.

b See description, page 43[illegible].

Owing to cross currents underneath the bridge at times of low water, the current meter measurements are made by wading at a point 300 feet below the bridge. During the present year the following discharge measurements have been made:

DATE.	Gauge height, feet.	Discharge, second-feet.
August 29, 1901	1.[illegible]	[illegible]
August 19, 1901	1.[illegible]	[illegible]
August 27, 1901	1.[illegible]	[illegible]
October 11, 1901	1.[illegible]	[illegible]
June 26, 1901	2.10	[illegible]

A rough measurement of the discharge at Wood Road Bridge May 1, 1900, showed a total flow of 289 second-feet.

The flow of Oriskany Creek at Wood Road Bridge represents the natural run-off of the tributary watershed of 144 square miles, modified by pond storage at numerous mills, with the additional flow during summer months due to diversion from storage reservoirs in Chenango River watershed through the summit level of the abandoned Chenango Canal into Oriskany Creek. The relation between the effective watershed during the canal season and during the winter months is shown below:

Drainage Area of Oriskany Creek.

	Square miles.
Natural drainage area above gauging station	143.[illegible]
Chenango River area made tributary through Chenango Canal in summer	[illegible]
Total effective drainage area during navigation season	[illegible]
Effective drainage area, canals closed	143.[illegible]

Storage Reservoirs on Chenango River. a

NAME OF RESERVOIR.	Storage depth, feet.	Average surface area, acres.	Impounding capacity, cubic feet.
Eaton Brook	50	254	[illegible],212,000
Hatch Lake	10	134	[illegible],370,400
Bradley Brook	25	136	145,[illegible],000
Kingsley Brook	20	113	[illegible],445,900
Madison Brook	40	235	[illegible],647,000
Leland Pond	8	173	[illegible],287,000

a State Engineer Bond's "Report on Barge Canal, 1901," p. 678, in report of "Engineer for Water Supply."

Owing to the maintenance of an equable summer flow through draft from these storage reservoirs, Oriskany Creek forms an excellent water power stream.

Daily Gauge Height of Oriskany Creek at Wood Road Bridge, Oriskany, N. Y.

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1	......	......	......	......	......	......	1.8	1.8	2.25	1.8	1.8	3.7
2	......	......	......	......	......	......	1.8	1.8	2.2	1.85	1.7	3.65
3	......	......	......	......	......	......	1.85	1.65	2.1	1.9	1.75	3.5
4	......	......	......	......	......	......	1.75	1.6	1.7	1.8	1.7	3.4
5	......	......	......	......	......	......	1.95	1.55	1.7	1.9	1.7	3.25
6	......	......	......	......	......	......	2.9	1.6	1.65	1.8	1.7	2.7
7	......	......	......	......	......	......	2.8	1.9	1.6	1.75	1.6	2.6
8	......	......	......	......	......	......	2.1	1.9	1.55	1.7	1.75	3.5
9	......	......	......	......	......	......	1.95	1.9	1.55	1.6	1.7	4.25
10	......	......	......	......	......	......	1.85	1.75	1.5	1.7	1.7	5.85
11	......	......	......	......	......	......	1.85	1.7	1.65	1.65	1.9	4.3
12	......	......	......	......	......	......	1.75	1.8	1.8	1.6	2.4	2.45
13	......	......	......	......	......	......	1.85	1.6	1.5	1.85	2.75	2.6
14	......	......	......	......	......	......	1.75	1.5	1.8	1.8	2.4	3.9
15	......	......	......	......	......	......	1.75	1.6	1.9	1.9	2.1	7.85
16	......	......	......	......	......	......	1.7	1.85	1.75	1.9	1.95	4.25
17	......	......	......	......	......	......	1.95	1.7	1.8	1.9	2.2	3.4
18	......	......	......	......	......	......	1.95	1.7	1.7	2.0	2.4	3.0
19	......	......	......	......	......	......	1.7	1.65	1.7	2.0	2.25	3.65
20	......	......	......	......	......	......	1.45	1.6	1.7	2.0	2.05	2.65
21	......	......	......	......	......	......	1.6	1.8	1.65	1.95	2.25	2.8
22	......	......	......	......	......	......	1.65	1.8	1.7	1.85	2.8	2.9
23	......	......	......	......	......	......	1.7	1.65	1.7	1.8	2.45	2.8
24	......	......	......	......	......	......	1.7	1.6	1.65	1.9	2.45	3.05
25	......	......	......	......	......	2.2	1.6	1.6	1.6	1.7	2.7	3.7
26	......	......	......	......	......	2.15	1.7	1.65	1.6	1.75	2.7	3.5
27	......	......	......	......	......	2.0	......	1.65	1.75	1.8	2.65	3.35
28	......	......	......	......	......	1.95	1.6	1.85	1.55	1.8	2.6	3.8
29	......	......	......	......	......	2.0	1.8	1.7	1.75	1.75	2.95	4.83
30	......	......	......	......	......	1.8	1.85	1.6	1.95	1.7	3.65	4.3
31	......	......	......	......	......	......	1.85	1.5	1.8	1.75	......	4

SAUQUOIT CREEK AT NEW YORK MILLS, ONEIDA COUNTY, N. Y.[a]

This stream rises in Oneida county and flows in a northerly direction, emptying into Mohawk River. It is shown in a part of its course on the Oriskany topographic sheet of the United States Geological Survey. Observations of flow are made at the dam which furnishes power to the upper, or No. 3 mill of the New York Mills.

The dam is of earth with plank facing, having a spillway 105.8 feet in length. The profile of the crest is somewhat irregular, and, in order to facilitate computation, has been divided into nine parts. Each part is assumed to have a horizontal crest line.

a See Water Supply and Irrigation Paper, U. S. Geol. Survey, No. 35, page 48.

In the mill are two [illegible] Hercules turbines, which are [illegible] and day a large part of the year.

During the summer but little water flows over the dam, [illegible] volume being used to drive the water wheels in the [illegible] cotton mill.

The leakage of the dam was measured by current meter [illegible] and found to be 5.6 second-feet.

This station was abandoned October 1, [illegible].

Mean Monthly Run-off of Sauquoit Creek at New York Mills, N. Y.

(Drainage area, [illegible] square miles.)

Month.	Second-feet.			Second-feet per square mile.			Inches on drainage area.		
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
January	......	[illegible]	[illegible]	......	[illegible]	[illegible]	......	[illegible]	[illegible]
February	....	[illegible]	[illegible]	......	[illegible]	[illegible]	......	[illegible]	[illegible]
March	......	[illegible]	[illegible]	......	[illegible]	[illegible]	......	[illegible]	[illegible]
April	......	[illegible]	[illegible]	......	[illegible]	[illegible]	....	[illegible]	[illegible]
May	......	[illegible]	[illegible]	......	[illegible]	[illegible]	....	[illegible]	[illegible]
June	......	[illegible]	[illegible]	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
July	......	[illegible]	[illegible]	.....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
August	.....	[illegible]	[illegible]	....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
September	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
October	[illegible]	[illegible]	......	[illegible]	[illegible]	......	[illegible]	[illegible]	[illegible]
November	[illegible]	[illegible]	......	[illegible]	[illegible]	......	[illegible]	[illegible]	[illegible]
December	[illegible]	[illegible]	......	[illegible]	[illegible]	......	[illegible]	[illegible]	[illegible]

SAUQUOIT CREEK AT YORKVILLE, ONEIDA COUNTY, N. Y.

A continuous gauging record of Sauquoit Creek has not been maintained during 1901. Current meter measurements have been made as shown below, at the New York Central and Hudson River Railroad bridge, which crosses the stream on Mohawk River flats one-half mile above the mouth of Sauquoit Creek.

Mean Daily Flow in Second-feet of Sauquoit Creek at New York Mills [No. 3].

[Drainage area, 51.5 square miles.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1898.												
1	......	......	......	......	......	......	......	......	......	16	42	49
2	......	......	......	......	......	......	......	......	......	7*	43	44
3	......	......	......	......	......	......	......	......	......	27	38	34
4	......	......	......	......	......	......	......	......	.....*	18	36	50*
5	......	......	......	......	......	......	......	......	......	31	32	46
6	......	......	......	......	......	......	......	......	......	54	59*	42
7	......	......	......	......	......	......	......	......	......	35	38	44
8	......	......	......	......	......	......	......	......	......	33	36	49
9	......	......	......	......	......	......	......	......	......	23*	38	42
10	......	......	......	......	......	......	......	......	......	35	132	28
11	......	......	......	......	......	......	......	......	.....*	53	140	22*
12	......	......	......	......	......	......	......	......	......	46	58	43
13	......	......	......	......	......	......	......	......	......	46	69*	42
14	......	......	......	......	......	......	......	......	......	46	62	36
15	......	......	......	......	......	......	......	......	......	144	53	37
16	......	......	......	......	......	......	......	......	......	30*	49	43
17	......	......	......	......	......	......	......	......	......	105	49	34
18	......	......	......	......	......	......	......	......	.....*	105	49	30*
19	......	......	......	......	......	......	......	......	......	60	43	42
20	......	......	......	......	......	......	......	......	18	36	95*	38
21	......	......	......	......	......	......	......	......	26	38	46	76
22	......	......	......	......	......	......	......	......	18	42	61	104
23	......	......	......	......	......	......	......	......	16	73*	69	268
24	......	......	......	......	......	......	......	......	22	71	76	99
25	......	......	......	......	......	......	......	......	37*	48	42	76*
26	......	......	......	......	......	......	......	......	30	59	66	63
27	......	......	......	......	......	......	......	......	40	140	62*	46
28	......	......	......	......	......	......	......	......	40	74	36	44
29	......	......	......	......	......	......	......	......	30	68	43	38
30	......	......	......	......	......	......	......	......	21	66*	42	74
31	......	......	......	......	......	......	......	......	......	57	......	53
Mean	......	......	......	......	......	......	......	......	27	56	57	57
1899.												
1	73	42	71	45	56	42	12	17	18	.....*	53	19
2	158	36	48	40*	50	34	.....*	11	5	20	42	13
3	68	38	46	57	43	18	27	43	.....*	24	21	23*
4	111	18	42	73	36	30*	10	30	......	21	26	32
5	140	40*	680*	104	33	42	30	12	33	15	29*	22
6	74	35	109	165	23	56	27	.....*	32	16	32	26
7	50	36	72	183	26*	48	18	36	6	8	32	26
8	13*	26	73	47	47	39	16	25	21	13*	24	19
9	58	30	68	156*	35	23	25*	22	12	18	24	12
10	38	31	60	100	26	34	31	......	.....*	18	19	14*
11	30	6	85	144	30	13*	30	25	22	18	29	16
12	36	65*	300*	160	50	28	27	14	19	18	29*	73
13	54	35	87	585	25	20	19	.....*	19	16	29	64
14	41	35	85	850	9*	19	22	25	8	7	24	36
15	186*	29	83	258	47	30	13	22	5	13*	24	32
16	57	29	71	228*	36	34	30*	18	15	18	21	36
17	68	33	50	122	52	33	23	5	.....*	15	24	35*
18	48	37	48	118	47	7*	27	18	19	16	21	38
19	30	13*	447*	119	51	30	27	5	19	18	24*	32
20	36	43	80	98	53	30	19	.....*	13	14	26	42
21	42	58	65	90	13*	28	11	22	14	12	26	54
22	13*	409	87	58	53	21	8	19	21	13*	26	35
23	43	100	90	86*	35	25	.....*	16	10	24	25	32
24	52	62	90	59	36	23	27	5	.....*	18	21	30*
25	44	50	55	80	29	23*	30	15	22	22	18	25
26	44	65*	95*	76	33	26	23	10	15	19	22*	32
27	42	173	69	58	20	30	27	.....*	22	15	24	28
28	14	62	79	54	40*	19	11	23	13	7	24	16
29	59*	......	76	43	42	20	14	30	13	19*	21	19
30	36	......	71	50*	43	21	.....*	18	10	22	21	13
31	30	......	78	......	43	......	27	5	......	26	......	14*
Mean	56	59	111	127	38	28	20	16	14	17	26	29

*Sundays.

[illegible]—Concluded.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
[illegible]												
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
23	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
26	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
29	[illegible]	—	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
30	[illegible]	—	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]
31	[illegible]		[illegible]	—	[illegible]	—	[illegible]	[illegible]	—	—	—	[illegible]
Mean	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	—

*[illegible]

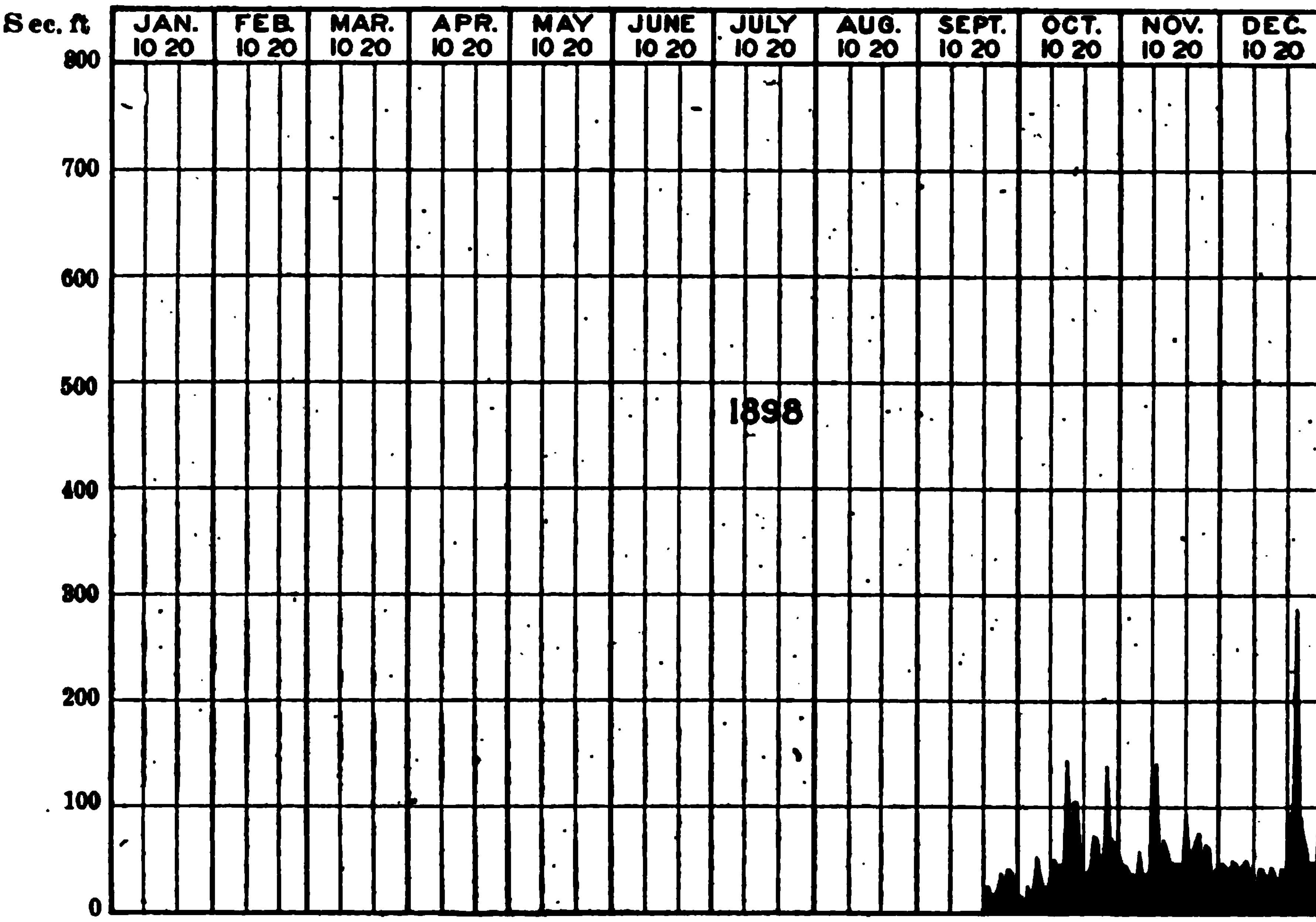


Fig. No. 51.—Discharge of Sauquoit Creek at New York Mills (No. 3), Oneida County, N. Y., 1898.

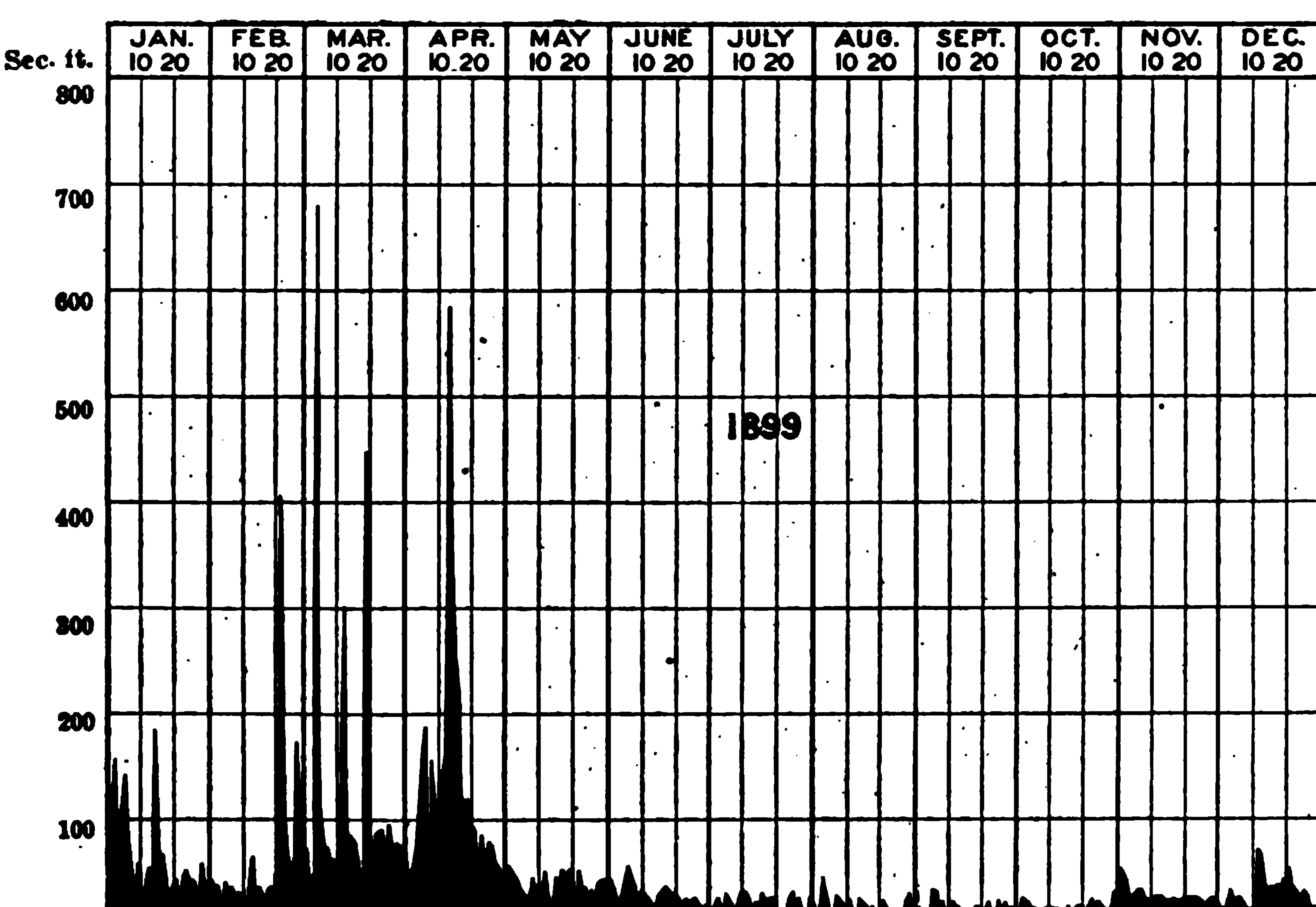
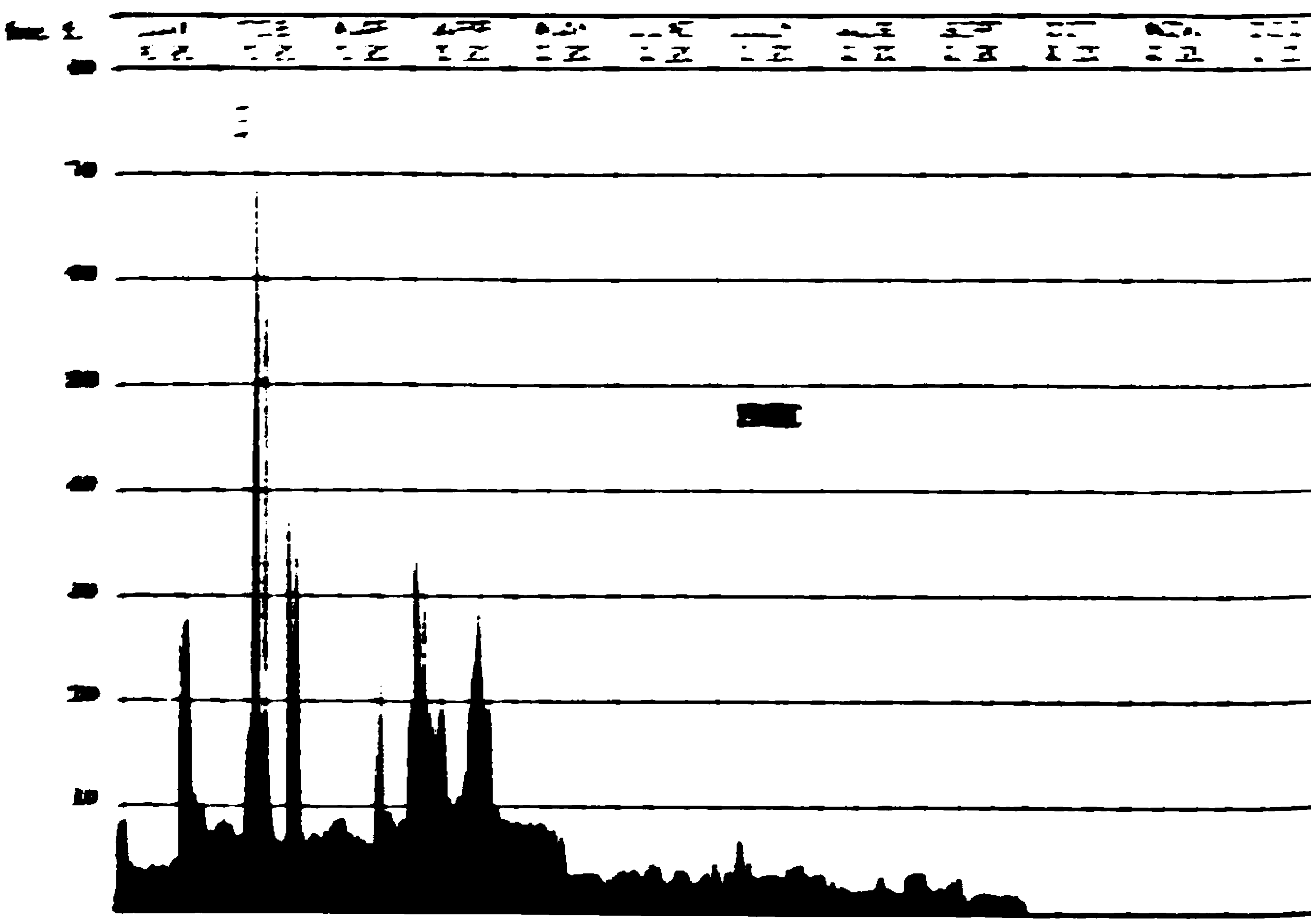


Fig. No. 52.—Discharge of Sauquoit Creek at New York Mills (No. 3), Oneida County, N. Y., 1899.



Principal Developed Water Powers on Sauquoit Creek in 1901.

Number of dam from mouth of stream.	LOCATION.	Name of mill or owner.	Manufacture.	Rated horse power of water wheels.							
1	New York Mills.	The New York Mills No. 4	Hosiery, yarns and corduroys.	366	30	27	28	......	......	......	
1	New York Mills...	The New York Mills No. 2	Hosiery, yarns and corduroys.	500	30	28	29	......	......	......	
2	New York Mills.	The [illegible] 3	Cotton cloth	800	16.5	17	16	......	......	......	
3	Capron.	Utic[illegible]	Cotton fabrics and yarns	100	21	21	21	150	90	220	
4*	New Hartford...	Divi[illegible]	Buffing and polishing wheels..	25	......	......	6	90	80	65	
4*	New Hartford....	New [illegible] Mill	Not operated	......	......	......	9	......	none.	none.	
4*	New Hartford....	New [illegible]	Custom Milling	......	......	......	12	3	none.	9	
4*	New Hartford ..	New Hartford Cotton Mfg. Company..	Unbleached cotton cloth	120	20	20	20	60	50	140	
5	Washington Mills	Utica Tool Company.	Agricultural hand tools..	150	14	12	13	90	none.	90	One wheel not run.
6	Washington Mills.	Washington Mills	Textile mill, abandoned	100	......	......	11	none.	none.	none.	Dam failed spring 1901.
7	Willowvale	Utica Willowvale Bleaching Company.	Bleaching and finishing	none.	......	......	9.5	135	135	270	Dam for water supply only.
8	Willowvale.	J. C. Dewhurst	Carriage shop	......	......	......	10	none.	none.	none.	Not operated; first water privilege.
8	Willowvale	J. H. Rehm	Saw, grist and cider mill	30	......	......	18	3	none.	3	Uses overflow or waste-water at dam.
9	Chadwicks	Chadwicks Mills Cotton Company....	Yarns, sheeting and corduroy.	......	25	22	22	45	60	135	Not in operation.
10	Sauquoit	Lewis Knitting Company	Cotton underwear	65	22	18	20	25	75	100	
11	Sauquoit	Sauquoit Valley Mills	Flour, feed, and saw mill	101	15	16	16	4	none.	4	
12	Sauquoit	Polk's Knife Factory	Farriers' knives	87	20	20	20	2	none.	2	
13	Sauquoit	Adolph Seigel, Lower Mill	Paper mill	none.	20	20	20	none.	none.	none.	Mill not operated.
14	Sauquoit	Adolph Seigel, Upper Mill	Pulp mill	none.	24	20	22	15	none.	15	Dam destroyed; runs by steam.
15	Clayville	Alfred King	Foundry	60	15	16	15	......	......	......	
16	Clayville	Empire Woolen Company	Worsted and cashmeres	60	26	24	25	175	120	55	
17	Clayville	Empire Woolen Company	Dam now used for storage only.	none.	......	......	15	none.	none	none.	
18	Clayville	First National Bank, Utica	No power in use	none.	......	......	15	none.	none.	none.	
19	Clayville	Babbitt's Wire Works	Line wire	114	20	20	20	......	......	......	

* Water used in four levels; total fall in power canal, 43 feet.

Meter-measurements of flow of Sauquoit Creek at N. Y. C. & H. R. R. bridge one-half mile above mouth of creek.

DATE.	Gauge height, feet.	Discharge, second-feet.	Hydrographer.
August 27, 1901	16.6	13.7	J. D. Luther.
August 29, 1901	16.3	24.2	J. D. Luther.

The gauge height given is distance down to water surface from a bench mark on the top of the center brace of the upstream girder. The location of the bridge may be seen on the Oriskany sheet of the topographic atlas of the United States Geological Survey. The bridge is located below the lowest dam and water power on the stream. It is two miles below the gauging station formerly maintained at the upper New York Mills.[a] Owing to its rapid fall and favorale location near Utica, the available water powers of Sauquoit Creek have been developed to the fullest possible extent.

MOHAWK RIVER AT UTICA, ONEIDA COUNTY, N. Y.

A gauging station was established at the Genesee Street bridge across Mohawk River at Utica, March 21, 1901.

The bridge consists of two spans of 83 and 72 feet respectively. A vertical gauge board in two parts, has been secured to the downstream side of the central pier.

From Rome to Little Falls, a distance of 36 miles, Mohawk River flows through an alluvial valley, the stream channel being flanked by flood-plains one-half mile or more in width. This flat valley is flooded to a depth of several feet during freshets. The intensity of floods at Little Falls is ameliorated in some degree by this extensive natural storage reservoir. During the navigation season the regimen of the stream above Utica is highly artificial. At Rome nearly the entire flow above the State dam is often diverted into Erie Canal, as is also the flow of Oriskany Creek, the principal tributary between Rome and Utica. There is also a certain amount of return water from waste-weirs, some of which is brought through feeders to the canal from the adjacent watersheds of the Black, Chenango and

a See page 445.

Oneida Rivers. The run-off from the tributary area, or 500 square miles above the Utica gauging station, is much less during the canal season than it would be from an equal area of the watershed without diversion.

Current meter measurements of the flow at Utica Station have been made as shown in the following table. The flood measurement of March 27, 1901, does not include a small amount of water which passed over Deerfield road, crossing the neck of the river bend, in the bow of which the gauging station is situated.

Current Meter Discharge Measurements of Mohawk River at Utica.

DATE.	Elevation of water surface, feet.	Discharge, second-feet.
1901.		
August 8	893.85	125
August 2	893.95	161
August 1	894.15	232
October 11	894.32	232
July 31	894.70	405
July 31	894.75	465
May 11	896.18	786
June 1	896.94	1,107
May 31	897.74	1,293
June 4	899.18	1,583
June 24	401.48	2,573
December 16	404.65	5,817
March 27	406.12	10,688

The elevation of the water surface at Utica during previous severe floods, with the corresponding discharge estimated from a rating table deduced from the current meter measurements, is given below, the elevations having been furnished by Stephen E. Babcock, C. E.

Estimated Flood Discharges of Mohawk River at Utica.

DATE.	Elevation.	Estimated discharge, second-feet.
Mean low water	894.64	355
Freshet, November 22, 1900	898.49	1,470
Freshet, November 27, 1900	405.44	8,000
High water of 1890	405.68	8,800
High water, February 26, 1891	407.22	17,300
High water, 1892	406.44	12,500
High water, 1893	406.37	12,100
High water, 1894	405.62	8,600
High water, 1895	406.32	11,900
High water, 1899	405.52	9,300
High water, March 27, 1901	406.19	11,100
High water, December 15, 1901	406.75	14,300

From observations of flow during the summer of November, 1900, Mr. Babcock estimated the flood discharge of Mohawk River at Utica to be [illegible] second-feet.[a]

An aggregate of about five second-feet is diverted for water supply from Ballou, Starch Factory and Reels Creeks, three small tributaries entering Mohawk River just below the Utica gaging station. The location of the gaging station may be seen on the Utica quadrangle of the topographic atlas sheet of the United States Geological Survey.

Mean Monthly Run-off of Mohawk River at Utica, N. Y.

[Drainage area, [illegible] square miles.]

MONTH.	Second-feet.	Second-feet per square mile.	Inches on drainage area.
[illegible].			
January	----	----	----
February	----	----	----
March	----	----	----
April	[illegible]	1.35	4.32
May	[illegible]	[illegible]	[illegible]
June	[illegible]	[illegible]	[illegible]
July	[illegible]	[illegible]	[illegible]
August	[illegible]	[illegible]	[illegible]
September	[illegible]	[illegible]	[illegible]
October	[illegible]	[illegible]	[illegible]
November	[illegible]	[illegible]	[illegible]
December	[illegible]	[illegible]	[illegible]

a Engineer's report to the Mohawk River Straightening Commission, Utica, N. Y., [illegible], by Stephen E. Babcock.

Mean Daily Flow in Second-feet of Mohawk River at Utica, N. Y.

[Drainage area, 500 square miles.]

WEST CANADA CREEK AT TWIN ROCK BRIDGE AND TRENTON FALLS, ONEIDA COUNTY, N. Y.

Twin Rock Bridge crosses West Canada Creek two miles above Hinckley, practically at the point of emergence of the stream from the Adirondacks. The bridge is of iron, having two spans and a length of 167.5 feet between abutments. The stream bed is of gravel and rock, and the conditions are unusually favorable for a current meter station. A gauge board was set and a record commenced on September 7, 1900. The gauge is read at 7 a. m. and at 6 p. m. each day, and the average of the two daily readings is given in the following table:

Current Meter Discharge Measurements of West Canada Creek at Twin Rock Bridge.

DATE.	Gauge reading.	Discharge in second-feet.
September 7, 1900	0.45	189
April 11, 1901	3.20	1,295a
May 4, 1901	4.95	1,472a
August 8, 1901	3.81	804a
August 10, 1901	4.88	1,847a

a Probably affected by backwater.

During April, 1901, an unusually heavy drive of logs produced a jam in the mill pond above Hinckley dam, two miles below the gauging station. This jam remained in position through the summer and was carried out by high water December 15, 1901. The gauge readings at Twin Rock Bridge for this period are probably affected by backwater in some degree.

Black Creek enters West Canada Creek one-half mile above Twin Rock Bridge. A discharge measurement of this stream at Grant, two miles from the mouth, showed the discharge to be 62 second-feet on August 8, 1901.

The record at Twin Rock Bridge is kept by the Utica Electric Light and Power Company. This company has erected an electric power plant at Trenton Falls, four miles farther downstream. A concrete dam has been constructed, and a head of 265 feet is obtained on the turbines, which are of special design.

The relative drainage areas tributary to the different gauging stations on West Canada Creek are shown below:

LOCATION.	Drainage area, square miles.
Mouth	[illegible]
Middleville	[illegible]
Trenton Falls	[illegible]
Twin Rock Bridge	[illegible]

Daily Gauge Height, in feet, of West Canada Creek at Twin Rock Bridge, New York, for 1901.

DAY.	Sept.	Oct.	Nov.	Dec.	DAY.	Sept.	Oct.	Nov.	Dec.
1	......	0.55	0.90	1.40	17	0.45	1.65	1.50	1.50
2	......	.75	[illegible]	[illegible]	18	.30	1.00	1.90	1.50
3	......	.45	[illegible]	2.[illegible]	19	.30	.85	5.50	1.50
4	......	[illegible]	1.75	1.90	20	1.65	1.15	5.90	1.50
5	......	.60	1.25	1.75	21	2.90	.60	5.30	1.50
6	......	.55	1.70	1.55	22	2.55	.90	4.65	1.50
7	......	.65	4.55	1.40	23	1.30	2.30	3.75	1.75
8	......	.55	4.25	1.40	24	.95	2.45	2.40	1.70
9	0.25	.75	3.65	1.50	25	1.10	1.75	6.25	1.65
10	.32	.9	1.45	1.50	26	.90	1.70	6.30	1.60
11	.35	.55	2.75	1.50	27	.95	2.35	4.40	1.55
12	.32	[illegible]	1.9	1.50	28	1.00	1.95	2.55	1.50
13	.35	.60	1.55	1.50	29	.85	1.15	1.90	1.50
14	.35	1.25	1.40	1.50	30	.90	1.25	1.70	......
15	.35	1.3	1.50	1.50	31	......	1.50	......	......
16	.25	1.2	1.50	1.50					

Fig. No. 54.—West Canada Creek: Trenton Falls Gorge, Lewis and Herkimer Counties,

Daily Gauge Height of West Canada Creek at Twin Rock Bridge.

Heavy rains on frozen ground December 15, 1901, caused a freshet discharge over the Trenton Falls dam estimated at 36,300 second-feet or 96.8 second-feet per square mile.

It is probable that the intensity of this flood was increased to some extent by the failure of the Hinckley dam a short distance upstream. A high-water mark at Newport dam indicates a flood discharge for the freshet of August, 1898, of at least 22,000 second-feet, or 46.6 second-feet per square, mile from the tributary drainage area of 472 square miles. In August, 1874, a freshet at Hinckley produced an estimated discharge of 21,100 second-feet or 58.6 second-feet per square mile from the tributary drainage area of 360 square miles. The freshet of August, 1898, is estimated to have produced a discharge of 12,950 second-feet or 24.9 second-feet per square mile at Middleville.

WEST CANADA CREEK AT MIDDLEVILLE, HERKIMER COUNTY, N. Y.[a]

Measurements of West Canada Creek have been made at Middleville at the dam of the Nelson Knitting Company, which supplies power to four mills. The dam is of timber, with a nearly level crest, aside from the ice slide in the northern portion.

The principal element of uncertainty with this record in the past was considered to be leakage of the dam, etc., which had been taken at 50 second-feet. Current meter measurements were made on September 10, 1900, to determine the leakage of the dam and the low water flow of the stream at this station.

	Second-feet.
Highway bridge below dam, measured flow in main stream channel	113
Measured flow in hydraulic canal	132
Total flow from current meter measurements	245

The calculated flow from the gauge record gives the following results:

	Second-feet.
Flow over dam, gauge reading 0.67	60
Leakage previously estimated	50
Total flow in main channel	110
Calculated diversion to water wheels	131
Total flow as estimated	241

The stream-bed is of gravel and cobblestones. High water and ice have washed out deep holes below the toe of the dam, tending to increase the leakage. Measurements of the discharge below the dam in 1901 gave the following results:

[a] See Water Supply and Irrigation Paper, U. S. Geol. Survey, No. 35, p. 48.

March 28.

	Second-feet.
Metered flow in creek at highway bridge	4,55[illegible]
Metered flow in power canal at highway bridge	154
Total flow past highway bridge	4,713
Metered discharge over dam	4,528
Estimated discharge of turbines	162

August 10.

	Second-feet.
Metered flow past highway bridge	965
Metered flow in power canal	96
Total flow past highway bridge	1,061

October 5.

	Second-feet.
Metered flow in creek at highway bridge	480
Metered flow in power canal at highway bridge	28
Total flow past highway bridge	510
Flow over dam by meter	320
Flow over dam, estimated	230
Difference, leakage, etc	90

Mean Daily Flow in Second-feet of West Canada Creek at Middleville, N. Y.

[Drainage area, 518 square miles.]

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1899.												
1	......	......	......	......	......	......	......	......	......	......	[illegible]	[illegible]
2	......	......	......	......	......	......	......	......	......	......	[illegible]	[illegible]
3	......	......	......	......	......	......	......	......	......	......	[illegible]	[illegible]
4	......	......	......	......	......	......	......	......	......	......	[illegible]	[illegible]
5	......	......	......	......	......	......	......	......	......	......	[illegible]	[illegible]
6	......	......	......	......	......	......	......	......	......	......	[illegible]	[illegible]
7	......	......	......	......	......	......	......	......	......	1,[illegible]	[illegible]	[illegible]
8	......	......	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]
9	......	......	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]
10	......	......	......	......	......	......	......	......	......	[illegible]	1,[illegible]	[illegible]
11	......	......	......	......	......	......	......	......	......	[illegible]	4,[illegible]	[illegible]
12	......	......	......	......	......	......	......	......	......	[illegible]	4,[illegible]	[illegible]
13	......	......	......	......	......	......	......	......	......	[illegible]	2,[illegible]	[illegible]
14	......	......	......	......	......	......	......	......	......	[illegible]	1,[illegible]	[illegible]
15	......	......	......	......	......	......	......	......	......	2,[illegible]	1,[illegible]	1,[illegible]
16	......	......	......	......	......	......	......	......	......	1,[illegible]	[illegible]	1,[illegible]
17	......	......	......	......	......	......	......	......	......	1,[illegible]	[illegible]	1,[illegible]
18	......	......	......	......	......	......	......	......	......	[illegible]	[illegible]	1,[illegible]
19	......	......	......	......	......	......	......	......	......	[illegible]	[illegible]	1,[illegible]
20	......	......	......	......	......	......	......	......	......	[illegible]	[illegible]	1,[illegible]
21	......	......	......	......	......	......	......	......	......	[illegible]	[illegible]	1,[illegible]
22	......	......	......	......	......	......	......	......	......	[illegible]	[illegible]	1,[illegible]
23	......	......	......	......	......	......	......	......	......	1,[illegible]	[illegible]	2,[illegible]
24	......	......	......	......	......	......	......	......	......	1,[illegible]	[illegible]	2,[illegible]
25	......	......	......	......	......	......	......	......	......	1,[illegible]	[illegible]	1,[illegible]
26	......	......	......	......	......	......	......	......	......	1,[illegible]	[illegible]	1,[illegible]
27	......	......	......	......	......	......	......	......	......	2,[illegible]	[illegible]	1,[illegible]
28	......	......	......	......	......	......	......	......	......	2,[illegible]	1,[illegible]	[illegible]
29	......	......	......	......	......	......	......	......	......	1,[illegible]	[illegible]	[illegible]
30	......	......	......	......	......	......	......	......	......	1,[illegible]	[illegible]	1,[illegible]
31	......	......	......	......	......	......	......	......	......	[illegible]	......	1,[illegible]
Mean	......	......	......	......	......	......	......	......	......	1,[illegible]	1,[illegible]	1,[illegible]
1900.												
1	1,270*	1,135	1,[illegible]	[illegible]	2,973	1,114	[illegible]	[illegible]	[illegible]	[illegible]	1,[illegible]	[illegible]
2	1,241	1,285	1,354	525*	4,700	[illegible]	140*	[illegible]	[illegible]	310	2,[illegible]	[illegible]
3	1,373	1,335	1,246	[illegible]	2,046	[illegible]	[illegible]	[illegible]	140*	[illegible]	1,704	[illegible]
4	1,374	1,346	1,191	[illegible]	2,735	550*	116	[illegible]	[illegible]	[illegible]	1,[illegible]	[illegible]
5	3,445	1,252*	1,340*	[illegible]	1,926	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1,000*	[illegible]
6	3,500	1,203	1,635	[illegible]	1,455	480	[illegible]	155*	[illegible]	[illegible]	[illegible]	[illegible]
7	1,958	1,197	1,835	748	1,235*	294	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1,250
8	1,175*	1,172	1,297	1,097	1,157	314	[illegible]	[illegible]	[illegible]	190*	[illegible]	1,670
9	1,[illegible]	957	942	1,500*	2,170	[illegible]	675*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	752	1,535	873	1,007	1,422	182	[illegible]	[illegible]	140*	[illegible]	[illegible]	700*
11	462	1,350	751	1,588	1,473	150*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	736	1,400*	1,340*	2,230	1,139	[illegible]	443	294	[illegible]	210	400*	2,150
13	1,119	1,418	1,724	2,465	1,008	297	445	120*	[illegible]	[illegible]	[illegible]	4,770
14	1,132	1,227	1,632	3,228	985*	[illegible]	[illegible]	254	[illegible]	203	[illegible]	2,530
15	1,675*	1,666	1,191	3,582	1,197	233	[illegible]	216	[illegible]	140*	[illegible]	700
16	1,700	2,640	1,071	3,513*	956	[illegible]	430*	[illegible]	[illegible]	241	[illegible]	[illegible]
17	1,771	2,500	814	3,549	1,143	400	[illegible]	[illegible]	140*	[illegible]	[illegible]	600*
18	1,[illegible]	2,111	944	3,731	1,064	330*	[illegible]	205	197	[illegible]	[illegible]	1,600
19	627	2,410*	1,000*	4,477	1,193	[illegible]	470	174	[illegible]	217	[illegible]	1,800
20	519	1,542	1,175	5,717	1,033	331	365	110*	213	[illegible]	[illegible]	2,530
21	543	1,616	1,555	5,564	1,240*	373	287	[illegible]	[illegible]	[illegible]	[illegible]	2,530
22	535*	1,966	1,412	5,381	1,274	346	325	265	[illegible]	190*	[illegible]	1,400
23	565	2,044	1,179	6,085*	906	263	140*	257	[illegible]	[illegible]	[illegible]	980
24	616	1,764	1,180	5,956	804	[illegible]	241	[illegible]	140*	[illegible]	273	1,150*
25	771	1,640	1,283	5,904	844	155*	241	264	[illegible]	[illegible]	273	900
26	763	1,490*	1,313*	6,994	801	283	241	183	476	231	[illegible]	640
27	640	1,564	764	6,205	728	273	244	110*	[illegible]	267	[illegible]	580
28	625	1,444	795	5,779	810*	280	[illegible]	255	[illegible]	[illegible]	[illegible]	[illegible]
29	675*	......	702	4,969	1,253	308	171	247	213	[illegible]	[illegible]	[illegible]
30	815	......	695	4,513*	1,179	225	115*	[illegible]	[illegible]	1,000	[illegible]	540
31	1,010	......	758	......	1,191	......	204	[illegible]	......	[illegible]	......	[illegible]
Mean	1,150	1,504	1,178	3,385	1,456	307	[illegible]	[illegible]	[illegible]	[illegible]	577	1,[illegible]

***Mean Daily Flow in Second-feet of West Canada Creek at Middleville, N. Y.*—(Concluded).**

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1900.		*a*	*a*	*a*								
1	894	.....	.....	.....	......	415	320*	362	457	470	598	1,517
2	722	.....	.....	.....	......	358	338	450	320*	469	463	1,282*
3	984	.....	.....	.....	......	530*	381	450	459	426	410	1,025
4	1,001	.....	.....	.....	......	490	330	315	453	401	323*	1,175
5	1,219	.....	.....	.....	......	524	299	190*	464	336	420	1,325
6	1,227	.....	.....	.....	......	522	259	249	494	219	491	1,395
7	1,240*	.....	.....	.....	......	491	358	235	524	198*	505	1,044
8	1,244	.....	.....	.....	......	557	500*	206	421	369	1,040	1,080
9	1,156	.....	.....	.....	......	676	528	205	280*	467	1,164	818*
10	1,108	.....	.....	.....	1,667	480*	448	168	401	404	1,149	677
11	972	.....	.....	.....	1,648	586	454	200	398	339	756*	578
12	937	.....	.....	.....	1,228	495	533	368*	324	327	738	488
13	930	.....	.....	.....	1,429*	420	442	437	278	330	586	488
14	963*	.....	.....	.....	1,087	412	350	971	270	280*	588	488
15	1,011	.....	.....	.....	1,281	368	320*	1,021	176	576	575	399
16	1,051	.....	.....	.....	1,069	341	439	1,516	136*	726	492	390*
17	1,068	.....	.....	.....	1,127	284*	424	541	227	646	460	412
18	1,442	.....	.....	.....	1,268	332	517	490	266	466	464*	418
19	2,400	.....	.....	.....	1,315	339	523	370*	283	466	723	463
20	1,485	.....	.....	.....	1,362*	334	487	415	291	324	1,550	502
21	2,680*	.....	.....	.....	959	281	547	344	331	170*	3,087	564
22	2,408	.....	.....	.....	744	316	530*	327	818	290	2,796	559
23	2,006	.....	.....	.....	637	298	488	269	947*	299	2,496	560*
24	2,874	.....	.....	.....	595	284*	349	258	940	778	3,024	812
25	2,896	.....	.....	.....	544	278	511	398	608	958	3,245*	942
26	2,093	.....	.....	.....	487	219	636	330*	574	727	6,108	898
27	2,894	.....	.....	.....	390*	306	567	506	464	461	5,837	900
28	730*	.....	.....	.....	466	326	445	561	364	460*	3,068	900
29	670	.....	.....	.....	428	530	378*	674	286	464	2,150	900
30	780	.....	.....	.....	380	431	481	599	320*	454	1,794	1,020*
31	580	.....	.....	.....	418	......	396	534	......	594	......	955
Mean	1,388	......	......	.....	924	406	451	463	419	448	1,536	800
1901.								*b*	*b*	*b*	*b*	*b*
1	849	778	489	1,571	1,802	1,401	424	......	......	......	......	......
2	852	772	585	1,574	1,672	1,505*	424	......	......	......	......	......
3	852	705*	654*	1,782	1,712	1,919	344	......	......	......	......	......
4	716	769	666	2,057	1,463	1,999	257	......	......	......	......	......
5	715	666	677	1,965	1,055*	1,529	304	......	......	......	......	......
6	710*	678	534	1,878	832	1,279	514	......	......	......	......	......
7	716	670	446	2,145*	712	2,719	545*	......	......	......	......	......
8	776	668	489	3,354	682	3,179	524	......	......	......	......	......
9	1,106	670	671	3,361	637	[illegible]	474	......	......	......	......	......
10	1,109	608*	714*	[illegible]	[illegible]	1,759	424	......	......	......	......	......
11	1,106	683	718	2,184	882	1,209	369	......	......	......	......	......
12	1,085	579	630	1,955	1,055*	869	369	......	......	......	......	......
13	1,069*	576	721	2,323	1,862	708	359	......	......	......	......	......
14	1,048	574	720	2,738*	1,802	577	265*	......	......	......	......	......
15	1,048	480	780	3,164	1,582	463	314	......	......	......	......	......
16	1,048	674	624	3,101	922	345*	314	......	......	......	......	......
17	966	566*	616*	3,465	852	378	314	......	......	......	......	......
18	714	550	629	3,735	1,082	463	314	......	......	......	......	......
19	894	501	780	4,189	1,135*	513	624	......	......	......	......	......
20	595*	499	783	3,981	1,292	418	664	......	......	......	......	......
21	1,032	589	997	3,232*	1,822	1,053	475*	......	......	......	......	......
22	941	539	1,999	7,621	1,062	1,718	369	......	......	......	......	......
23	1,051	641	2,096	7,605	1,162	1,985*	344	......	......	......	......	......
24	921	615*	2,202*	5,514	1,022	1,997	329	......	......	......	......	......
25	881	678	3,099	4,186	852	1,343	254	......	......	......	......	......
26	881	630	5,523	2,759	745*	743	254	......	......	......	......	......
27	895*	628	5,868	2,982	812	508	269	......	......	......	......	......
28	898	449	4,782	2,829*	922	338	285*	......	......	......	......	......
29	774	......	......	2,132	1,162	413	624	......	......	......	......	......
30	673	......	......	2,061	1,835	255*	1,184	......	......	......	......	......
31	778	......	......	......	1,890	......	1,464	......	......	......	......	......
Mean	871	624	1,380	3,167	1,114	1,197	448	......	......	......	......	......

a No record for February, March and April. *b* Record not available. * Sunday.

Mean Monthly Run-off of West Canada Creek at Middleville, N. Y.

[Drainage area, 518 square miles.]

IN SECOND-FEET.

MONTH.	1898.	1899.	1900.	1901.
January	....	1,150	1,366	561
February	....	1,594	....	624
March	....	1,178	....	1,3[illegible]
April	....	3,365	....	3,167
May	....	1,456	904	1,134
June	....	397	416	1,197
July	....	324	451	448
August	....	235	463	....
September	....	271	419	....
October	1,161	324	445	....
November	1,110	577	1,536	....
December	1,024	1,260	800	....

IN SECOND-FEET PER SQUARE MILE.

MONTH.	1898.	1899.	1900.	1901.
January	....	2.21	2.63	1.09
February	....	3.07	....	1.2[illegible]
March	....	2.26	....	2.5[illegible]
April	....	6.48	....	6.[illegible]
May	....	2.80	1.75	2.[illegible]
June	....	.76	.79	2.31
July	....	.62	.87	.86
August	....	.45	.89	....
September	....	.52	.80	....
October	2.24	.62	.86	....
November	2.14	1.11	2.97	....
December	1.97	2.43	1.54	....

IN INCHES ON DRAINAGE AREA.

MONTH.	1898.	1899.	1900.	1901.
January	....	2.54	3.03	1.33
February	....	3.19	....	1.25
March	....	2.60	....	2.96
April	....	7.23	....	6.85
May	....	3.22	2.05	2.69
June	....	.85	.87	2.61
July	....	.71	1.00	.99
August	....	.52	1.02	....
September	....	.58	.89	....
October	2.58	.71	.99	....
November	2.40	1.23	3.33	....
December	2.27	2.80	1.77	....

The lowest water in this stream occurs Sundays, when the flow is held back as pond storage by dams above Middleville. Aside from this, the most notable low water period was September 2 to 12, inclusive, 1899, the mean flow at Middleville for 11 days being 183 second-feet or 0.35 second-feet per square mile.

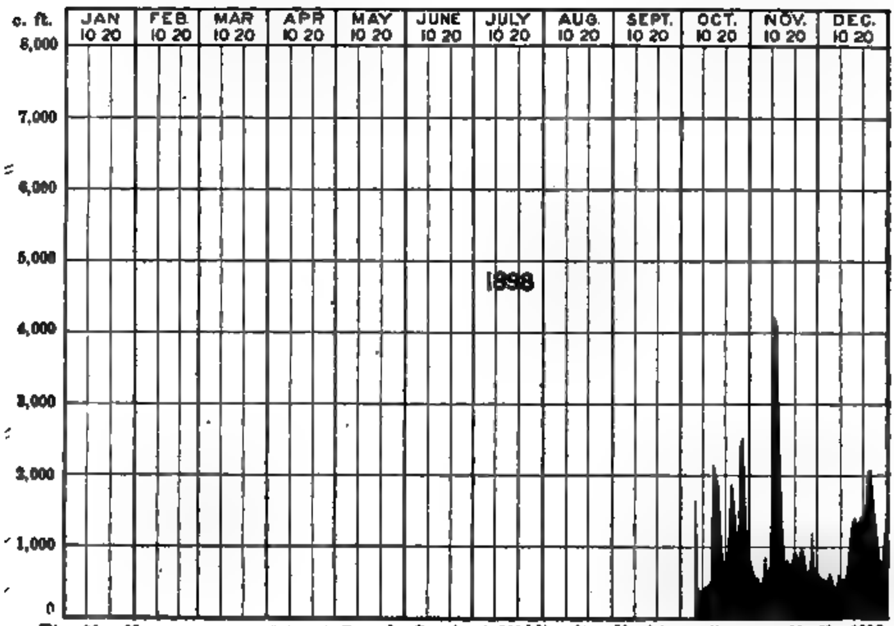


Fig. No. 55.—Discharge of West Canada Creek at Middleville, Herkimer County, N. Y., 1898.

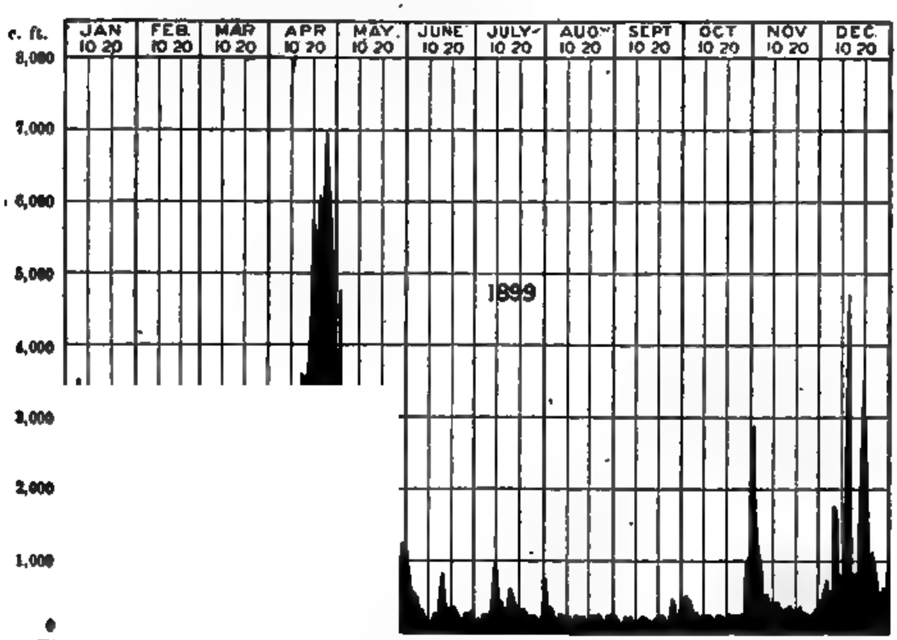


Fig. No. 56.—Discharge of West Canada Creek at Middleville, Herkimer County, N. Y., 1899.

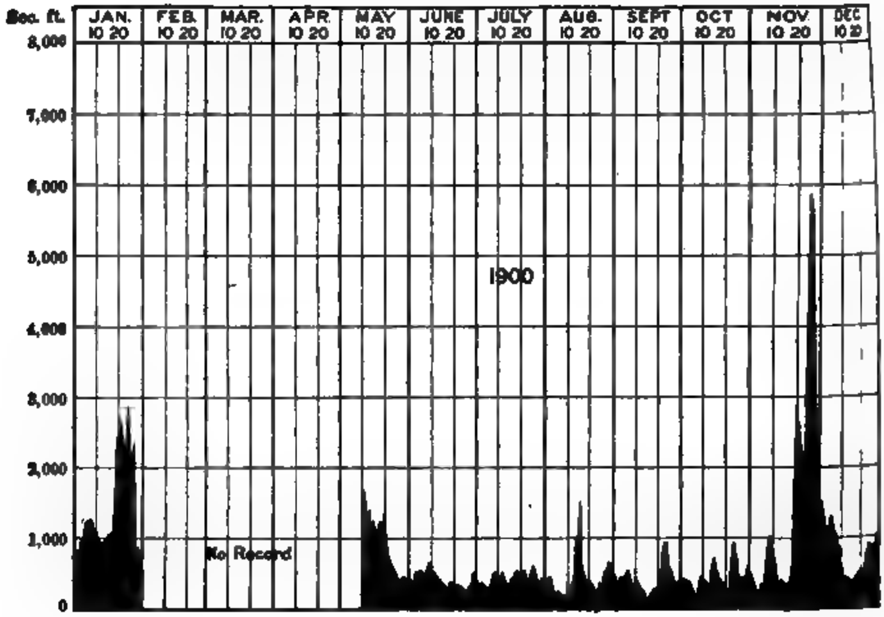


Fig. No. 57.—Discharge of West Canada Creek at Middleville, Herkimer County, N. Y., 1900.

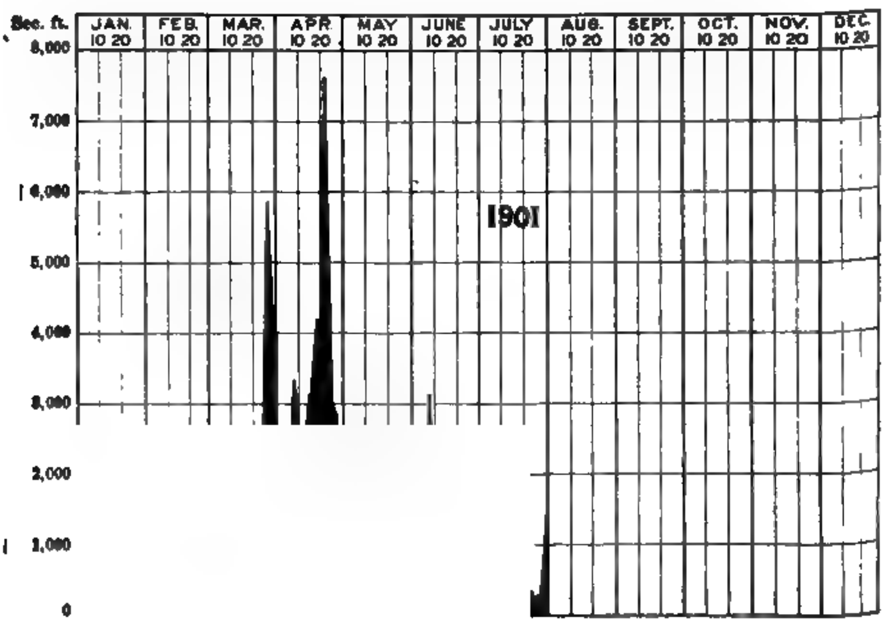


Fig. No. 58.—Discharge of West Canada Creek at Middleville, Herkimer County, N. Y., 1901.

EAST CANADA CREEK AT DOLGEVILLE, HERKIMER COUNTY, N. Y.

This creek rises in Hamilton County and flows in a southerly direction between Herkimer and Fulton Counties into Mohawk River at East Creek. A portion of the stream and drainage area are included on the Little Falls topographic atlas sheet of the United States Geological Survey. Observations are taken at High Falls near Dolgeville, about seven miles from the outlet of the stream. The gauging station is located at the dam of the Dolgeville Electric Light and Power Company. Readings of the depth on the crest are taken from a vertical gauge board attached to the bulkhead, 6 feet upstream, twice each day by Henry F. Schuyler. The mean of the readings is used in computing the discharge. A record is also kept of the run of the water wheels and the elevation of water in the tailrace.

The dam is of rubble masonry 19 feet high, and has a flat crest 6 feet in width and 190.25 feet long between abutments. The elevation of the upstream edge of the crest is one foot below that of the lip. The impounded water is conducted to the power house, 500 feet below the dam, through a wrought iron flume 10 feet in diameter. Prior to June 1, 1899, the discharge over the dam was computed from a discharge curve calculated by the use of coefficients derived from Cornell University Experiment No. 13[a]. The record since June 1, 1899, has been computed from a revised discharge curve based on Freeman's experiments on a model of the round-crested portion of the Croton Dam, which apparently corresponds closely with the ogee section of the Dolgeville dam as regards friction on the crest, vertical contraction of the nappe, and siphonage.[b] The flow through the turbines for this period has also been computed from current meter measurements made in the tailrace of the electric power plant, instead of from the manufacturers rating tables for the water wheels as formerly. The effect of these changes has been to slightly increase the extremes of flow, both a regards high and

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a Water Supply and Irrigation Paper, U. S. Geol. Survey, No. 35, p. 52.

b See Report on New York's Water Supply 1900, by John R. Freeman, C. E., p. 137.

low water. The estimated flow for mean stages remaining substantially the same.

During October 1901 [illegible] were set in the crest of the dam making flashboards [illegible]. The dam is practically water tight and no allowance is made for leakage. The discharge over the flashboards is estimated by means of the Francis formula.

The turbines are of a special [illegible] cylinder gate type; the two main wheels are 36 inches in diameter each and their speed is controlled by Lombard governors. The third wheel is 15 inches in diameter and drives the exciter. The following table shows the results of current meter measurements made from a bridge across the tailrace below the power plant. Only one of the two 36-inch turbines was running in each instance, together with the 15-inch exciter wheel. The latter runs at a [illegible] constant width of gate opening at all times. The head on the wheels was [illegible] feet. Observations on the wheel gate openings were taken at the beginning and end of each measurement and the average is given in the table.

DATE.	Measured flow in tailrace, second-feet.	Gate opening of 36-inch wheel.	Wheel number.
[illegible]			
May [illegible]	[illegible]	[illegible]	[illegible]
" [illegible]	[illegible]	[illegible]	[illegible]
" [illegible]	[illegible]	[illegible]	[illegible]
August [illegible]	[illegible]	[illegible]	[illegible]

The following measurements of the total discharge of the stream in comparison with the calculated flow, were also made.

DATE.	Total flow, second-feet.	Flow in tailrace, second-feet.	Flow over dam, second-feet.
[illegible]			
May [illegible]	[illegible]	[illegible]	[illegible]
July [illegible]	[illegible]	[illegible]	[illegible]
August [illegible]	[illegible]	[illegible]	[illegible]

a Measured in stream channel above point of confluence with tailrace.

DATE.	Crest-gauge reading, feet.	Flow over dam, second-feet.	Flow in tailrace, second-feet.	Total flow, second-feet.
1900.				
May 22	0.69	282	84	366
July 27	0.79	362	84	446
August 7	0.20	29	78	107

The total flow in the first two cases was measured at Dolgeville bridge one mile above the dam. The difference between the observed and calculated flows in the first instance is probably due to pond storage. The accompanying table of mean daily flow shows the amount of water passing down the stream from the dam each day. The discharge of the stream at High Falls represents the total water yield of the tributary drainage area, with the exception of water diverted for the municipal supply of Little Falls and Dolgeville.

Spruce Creek is the principal tributary of the East Canada Creek. It enters East Canada Creek one mile above Dolgeville and drains an area of 50 square miles. Water is diverted from this stream at Diamond Hill and from Beaver Creek, one of its tributaries, and is carried to Little Falls through a vitrified conduit nine miles in length. The water supply of Dolgeville is taken from Cold Brook, a tributary of East Canada Creek. No allowance for diversion for water supply has been made in computing the run-off for East Canada Creek.

Just below the foot of Spruce Creek reservoir at Diamond Hill occurs a fall of 180 feet in about 2,000 feet. At Salisbury Center, farther downstream, occurs a second fall of 85 feet in 900 feet, a number of water power privileges being developed at this point. There are a total of 12 dams on Spruce Creek, giving an aggregate fall of about 180 feet. East Canada Creek has a total fall of 445 feet from the crest of the dam at Dolgeville to the mouth of the stream. This includes a large amount of undeveloped fall.

BEARDSLEE FALLS.

At Beardslee Falls, two miles from the mouth of East Canada Creek, occurs a natural descent of 105 feet in two short cascades

over calciferous sand rock. The power at the lower fall is, at present, developed under a head of 57 feet, and supplies electric light and power to St. Johnsville, Fort Plain and Nelliston, Canajoharie and Palatine Bridge and to Ingham's Mills. A masonry dam at the head of the upper fall, 18 feet in height, has been constructed which affords a total available head of 120 feet, of which the electrical development is in progress. Blue Falls, between Ingham's Mills and Dolgeville, affords a natural descent of 30 feet, and is undeveloped.

Principal Developed Water Powers on East Canada Creek, [illegible].

Number of dam from mouth.	LOCATION.	Effective head in feet.	Manufacture.
1	East Creek (G. R. Beardslee)	120	Generation of electricity.
2	Ingham's Mills	10	Grist mill.
3	High Falls	72	Generation of electricity.
4	Dolgeville	20	Felt.
5	Stratford	......	Saw mill, piano factory.

Flood Discharge of East Canada Creek at Dolgeville.

DATE.	Second-feet.	Second-feet per square mile.
August 25, 1898	6,890	26.7
April 22, 1901	4,775	18.7
April 19, 1900	5,750	22.6
December 15, 1901	12,150	47.4

Fig. No. 59.—East Canada Creek Gauging-station: Masonry Dam of Electric Light and Power Company, Dolgeville, Herkimer County, N Y

Fig. No. 60.—East Canada Creek Beardslee Falls and Power Station, East Creek, Herkimer County, N. Y.

Mean Daily Flow in Second-feet. East Canada Creek at Dolgeville, N. Y.

[Drainage area, 256 square miles]

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1898.												
1	......	......	......	......	......	......	......	......	......	375	505	372
2	......	......	......	......	......	......	......	......	......	330*	478	372
3	......	......	......	......	......	......	......	......	......	275	443	372
4	......	......	......	......	......	......	......	......	......	270	368	372*
5	......	......	......	......	......	......	......	......	......	310	348	372
6	......	......	......	......	......	......	......	......	......	330	395*	372
7	......	......	......	......	......	......	......	......	......	290	398	Ice on crest of dam.
8	......	......	......	......	......	......	......	......	......	260	373	
9	......	......	......	......	......	......	......	......	......	218*	398	
10	......	......	......	......	......	......	......	......	......	262	648	
11	......	......	......	......	......	......	......	......	......	242	3,233	
12	......	......	......	......	......	......	......	......	......	267	1,937	
13	......	......	......	......	......	......	......	......	......	287	1,620*	
14	......	......	......	......	......	......	......	......	......	322	1,360	
15	......	......	......	......	......	......	......	......	......	1,422	1,110	
16	......	......	......	......	......	......	......	......	......	1,073*	850	
17	......	......	......	......	......	......	......	......	......	690	590	
18	......	......	......	......	......	......	......	......	......	465	540	
19	......	......	......	......	......	......	......	......	......	447	540	
20	......	......	......	......	......	......	......	......	......	477	630*	400
21	......	......	......	......	......	......	......	......	......	452	570	650
22	......	......	......	......	......	......	......	......	......	687	535	775
23	......	......	......	......	......	......	......	......	485	1,323*	500	1,275
24	......	......	......	......	......	......	......	......	1,180	1,062	465	975
25	......	......	......	......	......	......	......	......	943*	842	440	700*
26	......	......	......	......	......	......	......	......	680	762	370	600
27	......	......	......	......	......	......	......	......	625	1,222	305*	600
28	......	......	......	......	......	......	......	......	405	1,082	285	600
29	......	......	......	......	......	......	......	......	370	877	235	400
30	......	......	......	......	......	......	......	......	355	635*	279	450
31	......	......	......	......	......	......	......	......	......	602	......	600
Mean	......	......	......	......	......	......	......	......	683	581	689	564
1899.												
1	486*	472	542	462	1,701	384	116	118	109	135*	1,046	134
2	486	462	447	359*	1,401	294	82*	192	145	118	1,674	292
3	530	447	372	355	1,301	213	112	210	145*	106	574	335*
4	530	492	422	412	1,261	212*	79	189	78	106	757	385
5	1,320	370*	383*	452	1,006	206	106	99	78	94	648*	282
6	1,390	402	852	512	771	200	108	81*	71	89	540	234
7	1,185	397	787	642	474*	194	126	118	68	89	404	152
8	997*	397	632	922	421	234	215	112	67	94*	372	152
9	922	397	542	713*	371	194	324*	100	67	92	340	132
10	722	372	472	822	371	194	394	106	67*	89	322	195*
11	622	372	447	952	421	188*	270	126	67	77	282	258
12	542	348*	550*	1,217	401	194	194	143	74	75	258*	3,000
13	502	410	742	1,642	431	194	194	128*	67	74	234	3,029
14	562	462	772	2,152	584*	206	194	108	67	74	234	1,530
15	1,342*	502	722	2,972	601	264	175	83	67	74*	234	1,094
16	1,187	502	602	2,077*	541	249	304*	78	67	74	288	914
17	1,167	397	562	2,512	441	175	374	104	67*	77	258	783*
18	1,942	402	472	2,682	601	184*	264	78	67	118	234	1,825
19	822	370*	490*	3,532	811	239	175	76	67	100	234*	1,947
20	742	447	542	4,182	741	161	126	75*	74	108	234	676
21	642	477	572	4,472	674*	274	119	74	74	100	208	1,422
22	542*	590	602	3,472	601	206	100	74	74	90*	292	574
23	572	992	602	3,791*	541	174	112*	67	74	81	292	757
24	552	742	702	3,992	471	183	106	74	74*	100	184	648*
25	672	512	672	3,992	421	112*	110	94	74	94	152	542
26	672	460*	520*	4,182	391	152	135	74	192	94	148*	436
27	642	742	447	3,782	371	152	111	44*	192	89	143	330
28	602	742	492	3,592	324*	144	135	74	139	89	143	282
29	542*	......	472	3,017	391	119	115	74	126	266*	134	282
30	522	......	492	2,141*	378	119	101*	74	152	372	134	254
31	472	......	472	......	421	......	87	74	......	246	......	259*
Mean	816	439	519	1,978	633	166	166	97	92	112	377	706

*Sunday.

Mean Daily Flow in Second-feet of East Canada Creek at Dolgeville, N. Y.—Concluded.

[Drainage area, [illegible] square miles.]

Day.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1900.												
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
26	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29	[illegible]	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
30	[illegible]	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
31	[illegible]	......	[illegible]	......	[illegible]	......	[illegible]	[illegible]	......	[illegible]	......	[illegible]
Mean......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1901.												
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......	......	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......	......	[illegible]	......	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]	......	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]	[illegible]
14	[illegible]	[illegible]	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	[illegible]	[illegible]	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	[illegible]	[illegible]	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]	[illegible]
21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
26	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]	[illegible]
29	[illegible]	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
30	[illegible]	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
31	[illegible]	......	[illegible]	......	[illegible]	......	[illegible]	[illegible]	......	[illegible]	......	[illegible]
Mean......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

* Sunday. a No record.

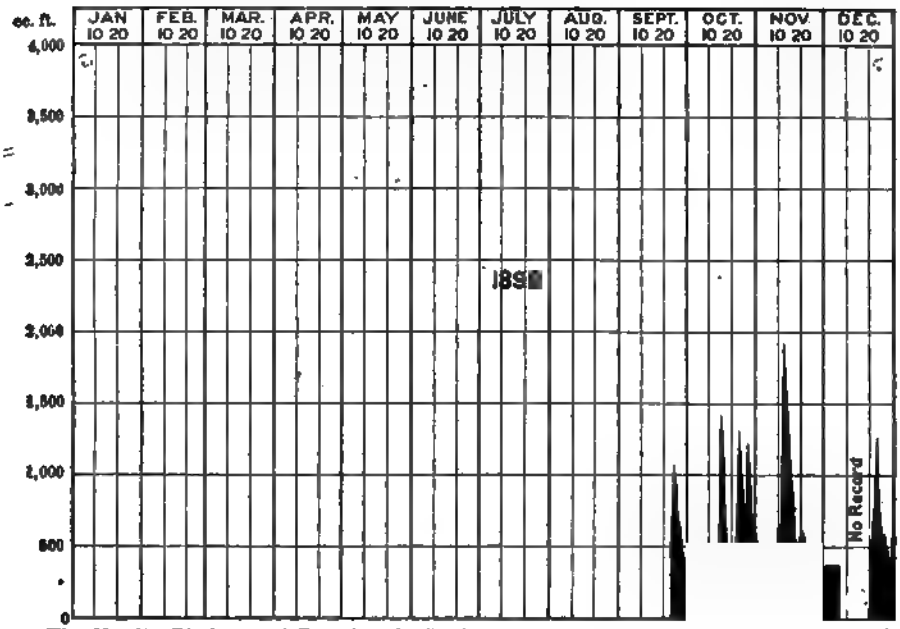

Fig. No. 61.—Discharge of East Canada Creek at Dolgeville, Herkimer County, N. Y., 1898.

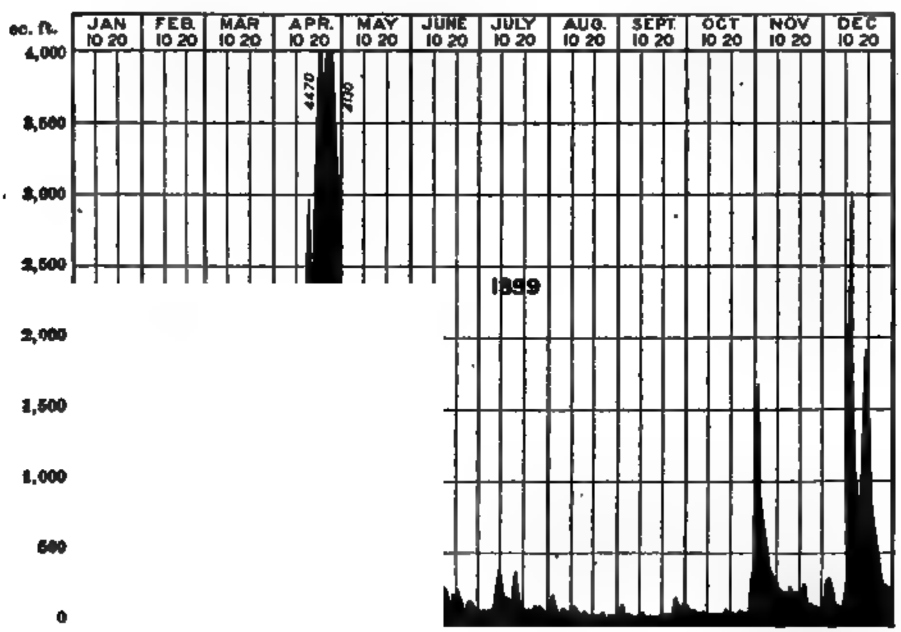

Fig. No. 62.—Discharge of East Canada Creek at Dolgeville, Herkimer County, N. Y., 1899.

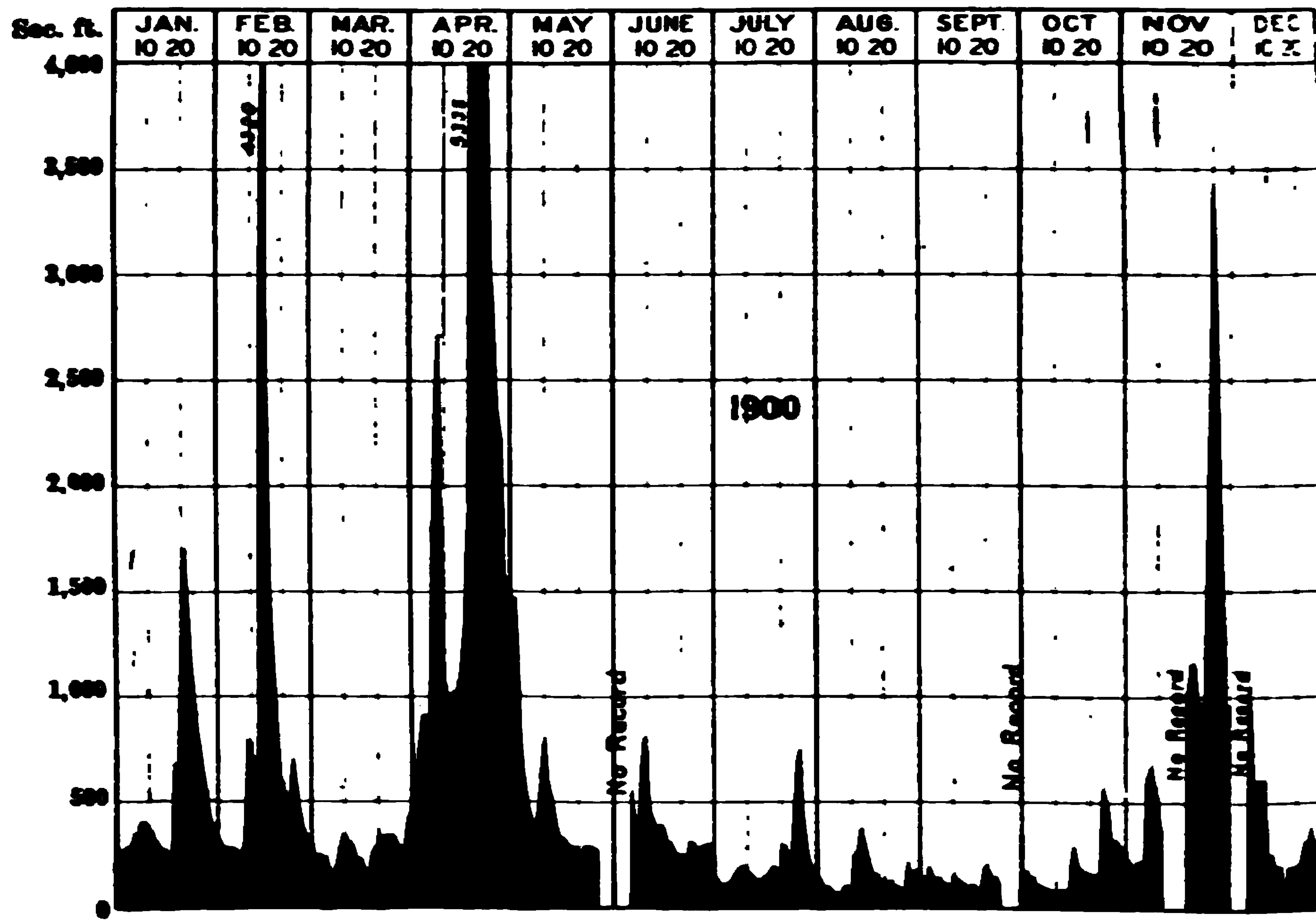

Fig. No. 63.—Discharge of East Canada Creek at Dolgeville, Herkimer County, N. Y., 1900.

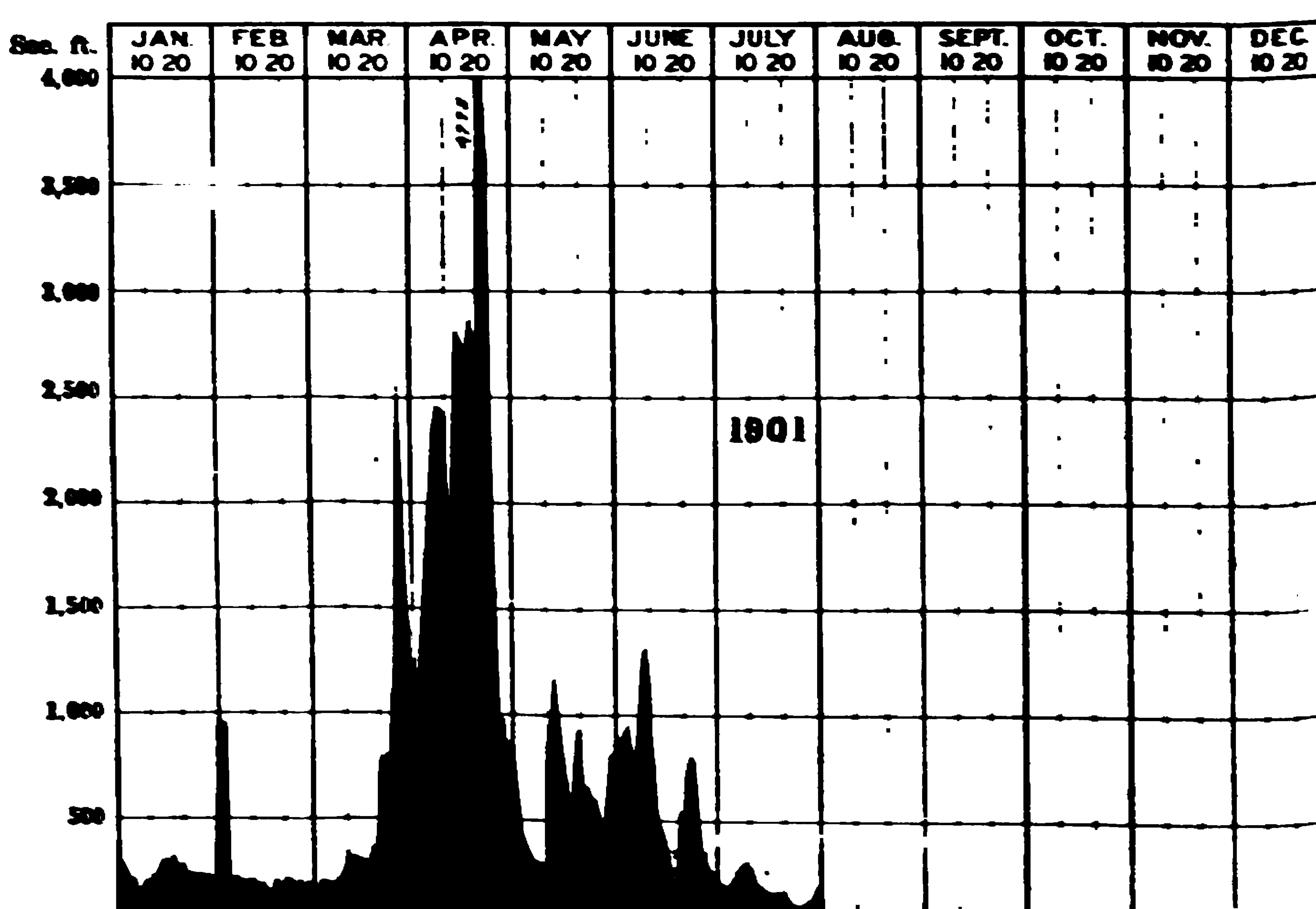

Fig. No. 64.—Discharge of East Canada Creek at Dolgeville, Herkimer County, N. Y., 1901.

Mean Monthly Run-off of East Canada Creek at Dolgeville, Herkimer County, N. Y.

[Drainage area, 256 square miles.]

MONTH.	SECOND-FEET.				SECOND-FEET PER SQUARE MILE.				INCHES ON DRAINAGE AREA.			
	1898.	1899.	1900.	1901.	1898.	1899.	1900.	1901.	1898.	1899.	1900.	1901.
January	......	816	531	235	......	3.19	2.08	0.92	......	3.67	2.39	1.06
February	......	439	879	248	......	1.71	3.43	0.97	......	1.77	3.56	1.01
March	......	519	276	691	......	2.03	1.08	2.69	......	2.34	1.24	3.09
April	......	1,978	2,086	2,094	......	7.73	8.15	8.15	......	8.65	9.12	9.12
May	......	633	486	629	......	2.47	1.90	2.45	......	2.84	2.19	2.81
June	......	196	370	564	......	0.76	1.44	2.20	......	0.85	1.60	2.46
July	......	166	221	174	......	0.65	0.86	0.68	......	0.75	0.99	0.78
August	......	97	144	190	......	0.38	0.56	0.74	......	0.43	0.64	0.85
September	638	92	133	249	2.49	0.36	0.52	0.97	2.79	0.40	0.58	1.09
October	581	112	195	252	2.27	0.43	0.76	0.98	2.61	0.49	0.87	1.13
November	689	377	957	359	2.69	1.47	3.73	1.40	3.01	1.64	4.18	1.56
December	564	706	368	935	2.20	2.73	1.44	3.65	2.53	3.18	1.66	4.20

The most notable low water period was September 13th to 16th inclusive, 1899, the average volume of flow being 67 second-feet or 0.3 second-feet per square mile for four days.

DRAINAGE AREAS OF EAST CANADA CREEK.

LOCATION.	Square miles.
Above High Falls	256
Above mouth	283

MOHAWK RIVER AT LITTLE FALLS, HERKIMER COUNTY, N. Y.[a]

This gauging station is located at the lower, or Gilbert's Dam, at Little Falls.

The dam is of masonry, having the form of a circular arc in plan, and furnishes power for the Astoronga Knitting Mill and the Little Falls Paper Company's Mills. In the Astoronga Knitting Mill there are installed two turbines, one 43 inches and the other 54 inches in diameter, built by T. H. Risdon & Co., Mount Holly, N. J. In the Little Falls Paper Company's Mill are three Camden turbines, and one 60-inch Day turbine, built in Little Falls.

[a] See Water Supply and Irrigation Paper, U. S. Geol. Survey, No. 35, p. 51.

Current meter measurements have been made to check the calculated flows with very satisfactory results.

October [illegible], 1906, at suspension bridge, two miles below Little Falls. W. D. Lockwood, hydrographer.

	Second-feet
Total flow by current meter	[illegible]
Computed flow, mean of two days	[illegible]

May [illegible], 190[illegible], at suspension bridge. R. E. Horton, hydrographer.

	Second-feet
Total flow by current meter	[illegible]
Computed flow over dam	[illegible]
Computed diversion to Gilbert's mill ...	[illegible]
Computed diversion to paper mill	[illegible]
Total computed flow	[illegible]

May [illegible], 190[illegible], at [illegible] bridge, Little Falls. R. E. Horton, hydrographer.

	Second-feet
Total flow by current meter	[illegible]
Computed flow over dam	[illegible]
Computed diversion to Gilbert's mill	[illegible]
Computed diversion to paper mill	416
Total computed flow	[illegible]

Diversion to paper mill September [illegible], 1906.

Metered flow in headrace	[illegible]
Computed flow through turbines, etc.....	[illegible]

April 9, 1901, at suspension bridge. R. E. Horton, hydrographer.

	Second-feet.
Total flow by current meter	10,095
Estimated flow at Little Falls	9,880

There are three dams at Little Falls. The lower two are used for water power development. The upper one is a State dam, diverting water for the supply of Erie canal. The gauge record as kept at the lower dam shows the amount of water flowing downstream from Little Falls, but does not include diversion at the State dam above the gauging station, and hence does not represent the total yield or inflow from the tributary drainage area of 1,306 square miles.

Current meter measurements have been made in the feeder channel below the State dam as follows:

1900.	Measured diversion, second-feet.
May 23	143
September 19	179

Mean Daily Flow in Second-feet of Mohawk River at Little Falls, N. Y., Lower Dam.

[Drainage area, 1,306 square miles.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1898.												
1	......	......	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]
2	......	......	......	......	......	......	......	......	......	976*	[illegible]	[illegible]
3	......	......	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]
4	......	......	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]
5	......	......	......	......	......	......	......	......	......	2,[illegible]	[illegible]	[illegible]
6	......	......	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]
7	......	......	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]
8	......	......	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]
9	......	......	......	......	......	......	......	......	......	976*	[illegible]	[illegible]
10	......	......	......	......	......	......	......	......	......	[illegible]	4,438	[illegible]
11	......	......	......	......	......	......	......	......	......	[illegible]	9,433	[illegible]
12	......	......	......	......	......	......	......	......	......	975	[illegible]	[illegible]
13	......	......	......	......	......	......	......	......	......	[illegible]	[illegible]*	[illegible]
14	......	......	......	......	......	......	......	......	......	[illegible]	5,[illegible]	[illegible]
15	......	......	......	......	......	......	......	......	......	5,[illegible]	[illegible]	[illegible]
16	......	......	......	......	......	......	......	......	......	5,[illegible]*	[illegible]	[illegible]
17	......	......	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]
18	......	......	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]*
19	......	......	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]
20	......	......	......	......	......	......	......	......	......	[illegible]	[illegible]*	[illegible]
21	......	......	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]
22	......	......	......	......	......	......	......	......	......	2,646	[illegible]	[illegible]
23	......	......	......	......	......	......	......	......	[illegible]	4,[illegible]*	[illegible]	[illegible]
24	......	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]
25	......	......	......	......	......	......	......	......	4,[illegible]*	[illegible]	[illegible]	[illegible]*
26	......	......	......	......	......	......	......	......	[illegible]	2,574	[illegible]	[illegible]
27	......	......	......	......	......	......	......	......	2,465	[illegible]	[illegible]*	[illegible]
28	......	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]
29	......	......	......	......	......	......	......	......	[illegible]	5,221	[illegible]	[illegible]
30	......	......	......	......	......	......	......	......	1,326	[illegible]*	[illegible]	[illegible]
31	......	......	......	......	......	......	......	......	......	2,[illegible]	......	1,573
Mean	......	......	......	......	......	......	......	......	2,[illegible]	2,[illegible]	2,[illegible]	2,[illegible]
1899.												
1	2,554*	941	3,252	3,941	6,[illegible]	1,597	580	586	228	700*	2,380	[illegible]
2	[illegible]	986	3,134	2,[illegible]*	[illegible]	[illegible]	498*	586	[illegible]	657	6,000	[illegible]
3	[illegible]	867	2,304	2,[illegible]	3,[illegible]	[illegible]	554	135	[illegible]*	657	4,730	[illegible]*
4	[illegible]	954	2,298	2,[illegible]	3,925	[illegible]*	434	136	386	497	3,081	[illegible]
5	6,[illegible]	664*	3,4[illegible]*	2,[illegible]	2,[illegible]	1,066	480	166	345	380	3,382*	2,[illegible]
6	7,644	1,363	5,544	4,257	2,390	1,274	683	680*	392	380	2,567	[illegible]
7	5,[illegible]	[illegible]	5,544	4,657	1,56[illegible]*	[illegible]	677	188	272	380	[illegible]	[illegible]
8	4,[illegible]*	951	5,134	7,[illegible]	[illegible]	[illegible]	651	[illegible]	225	[illegible]*	[illegible]	[illegible]
9	4,[illegible]	946	4,334	6,[illegible]*	[illegible]	962	1,007*	152	221	357	1,088	[illegible]
10	2,[illegible]	838	3,[illegible]	7,[illegible]	[illegible]	764	2,[illegible]	130	[illegible]*	297	1,652	[illegible]*
11	[illegible]	871	2,872	6,[illegible]	1,449	[illegible]*	1,[illegible]	576	273	274	[illegible]	2,[illegible]
12	[illegible]	789*	3,967*	7,579	1,544	661	1,[illegible]	383	[illegible]	386	1,[illegible]*	6,[illegible]
13	[illegible]	963	6,474	5,644	2,273	661	1,232	690*	[illegible]	274	1,538	[illegible]
14	[illegible]	913	6,139	12,454	1,93[illegible]*	[illegible]	941	339	[illegible]	256	[illegible]	4,445
15	4,[illegible]*	1,[illegible]	6,[illegible]	12,548	2,[illegible]	[illegible]	944	357	236	230*	[illegible]	[illegible]
16	4,943	1,333	6,354	12,443*	1,744	[illegible]	643*	357	154	354	[illegible]	3,54[illegible]
17	4,[illegible]	745	[illegible]	[illegible]	[illegible]	[illegible]	1,[illegible]	344	55*	330	[illegible]	[illegible]*
18	4,279	[illegible]	2,254	[illegible]	2,432	965*	[illegible]	257	229	344	1,[illegible]	1,088
19	[illegible]	665*	3,[illegible]*	[illegible]	2,443	566	[illegible]	226	257	330	[illegible]*	4,[illegible]
20	[illegible]	1,265	3,656	[illegible]	3,742	[illegible]	[illegible]	67*	257	335	[illegible]	3,340
21	1,9[illegible]	[illegible]	2,[illegible]	[illegible]	3,650*	[illegible]	[illegible]	158	280	[illegible]	[illegible]	[illegible]
22	[illegible]*	2,595	3,429	[illegible]	3,[illegible]	955	95	286	380	142*	[illegible]	5,[illegible]
23	[illegible]	4,556	3,494	[illegible]*	[illegible]	986	963*	286	139	380	1,086	[illegible]
24	[illegible]	4,[illegible]	3,694	[illegible]	[illegible]	745	436	286	55*	441	[illegible]	[illegible]*
25	[illegible]	3,464	3,336	[illegible]	[illegible]	[illegible]*	496	286	286	380	980	[illegible]
26	2,[illegible]	[illegible]*	3,[illegible]*	5,[illegible]	[illegible]	730	526	264	285	380	980*	[illegible]
27	[illegible]	2,[illegible]	2,[illegible]	5,[illegible]	[illegible]	634	436	130*	386	367	980	[illegible]
28	[illegible]	3,[illegible]	2,345	[illegible]	[illegible]*	565	5[illegible]	380	380	324	980	1,[illegible]
29	[illegible]*	......	2,[illegible]	[illegible]	2,3[illegible]	[illegible]	[illegible]	[illegible]	662	1,[illegible]*	980	[illegible]
30	[illegible]	......	[illegible]	6,250*	3,[illegible]	585	52*	229	238	2,386	986	1,[illegible]
31	[illegible]	......	3,[illegible]	......	2,[illegible]	......	687	[illegible]	......	1,[illegible]	......	88*
Mean	2,733	1,510	3,757	8,132	2,652	1,014	[illegible]	[illegible]	[illegible]	[illegible]	1,[illegible]	3,[illegible]

* Sunday.

Mean Daily Flow in Second-feet of Mohawk River at Little Falls, N. Y.—(Concluded).

[Drainage area, 1,306 square miles.]

*Sunday.

Mean Monthly Run-off of Mohawk River at Little Falls.

[Drainage area, 1,306 square miles.]

SECOND-FEET.

MONTH.	1898.	1899.	1900.	1901.
January	....	2,758	5,528	[illegible]
February	....	[illegible]	2,562	[illegible]
March	....	2,735	2,400	[illegible]
April	....	8,708	8,162	[illegible]
May	....	2,652	2,063	[illegible]
June	....	1,774	862	[illegible]
July	....	806	963	[illegible]
August	....	223	684	[illegible]
September	2,573	256	600	[illegible]
October	2,498	580	800	[illegible]
November	2,591	1,600	2,554	[illegible]
December	2,086	2,300	2,200	[illegible]

SECOND-FEET PER SQUARE MILE.

MONTH.	1898.	1899.	1900.	1901.
January	....	2.[illegible]	4.23	[illegible]
February	....	1.25	2.96	[illegible]
March	....	2.[illegible]	1.80	[illegible]
April	....	6.21	6.25	[illegible]
May	....	2.03	1.58	[illegible]
June	....	0.73	0.66	[illegible]
July	....	0.62	0.72	[illegible]
August	....	0.[illegible]	0.53	[illegible]
September	1.[illegible]	0.23	0.46	[illegible]
October	1.9[illegible]	0.39	0.60	[illegible]
November	2.2[illegible]	1.2[illegible]	2.95	[illegible]
December	1.56	2.5[illegible]	2.46	[illegible]

IN INCHES ON DRAINAGE AREA.

MONTH.	1898.	1899.	1900.	1901.
January	....	2.35	4.56	[illegible]
February	....	1.39	3.06	[illegible]
March	....	2.32	2.23	[illegible]
April	....	6.90	6.95	[illegible]
May	....	2.34	1.82	[illegible]
June	....	0.85	0.66	[illegible]
July	....	0.70	0.85	[illegible]
August	....	0.39	0.62	[illegible]
September	2.85	0.25	0.55	[illegible]
October	2.28	0.45	0.79	[illegible]
November	2.06	1.45	3.30	[illegible]
December	1.74	2.60	2.85	[illegible]

Adding these amounts to the mean daily flow at Gilbert's Dam, for the same dates, we obtain the following:

DATE.	Total inflow at Little Falls, second-feet.	Outflow in main channel, second-feet.
May [illegible]	2,386	1,650
September [illegible]	608	534

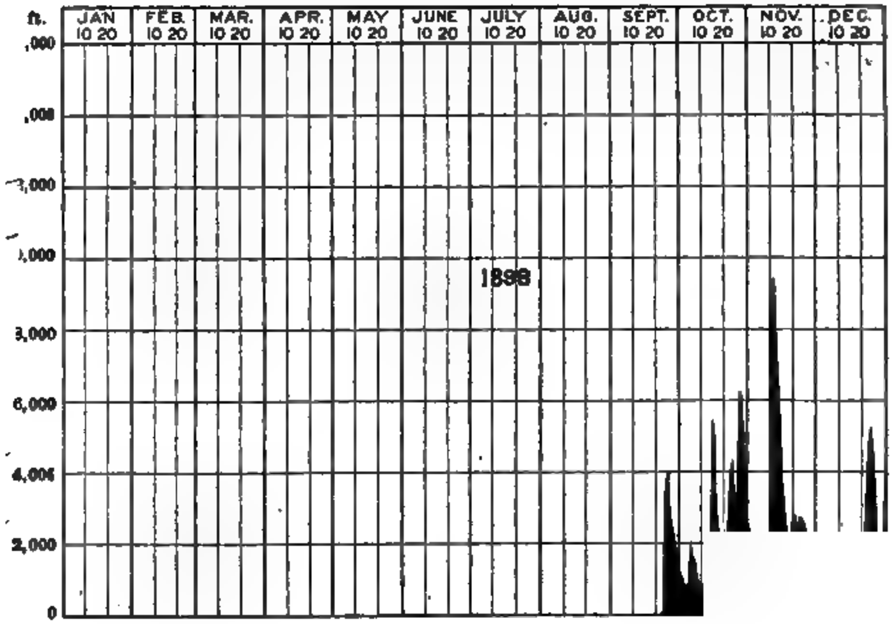

Fig. No. 65.—Discharge of Mohawk River at Little Falls, Herkimer County, N. Y., 1898.

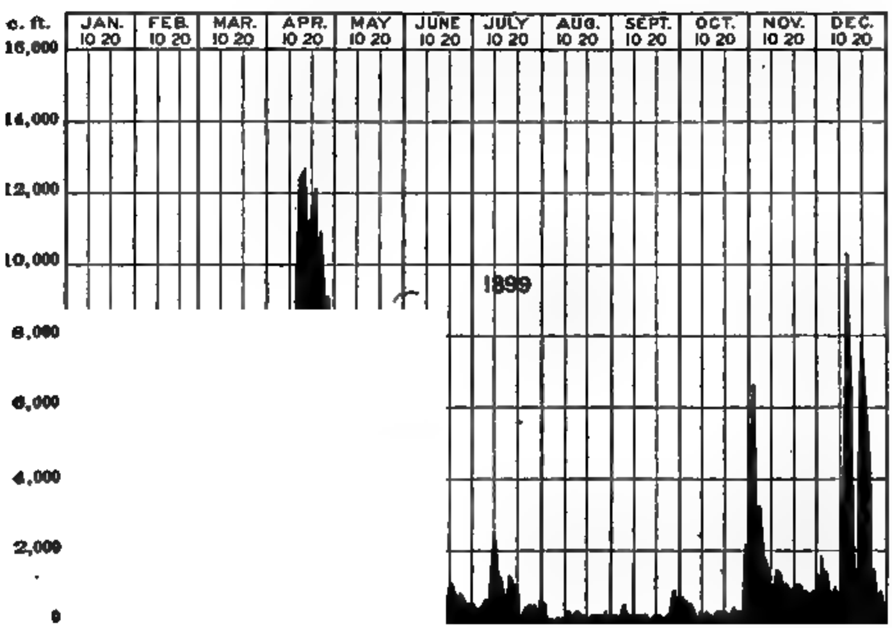

Fig. No. 66.—Discharge of Mohawk River at Little Falls, Herkimer County, N. Y., 1899.

Fig. No. 67.—Discharge of Mohawk River at Little Falls, Herkimer County, N. Y., 19[illegible]

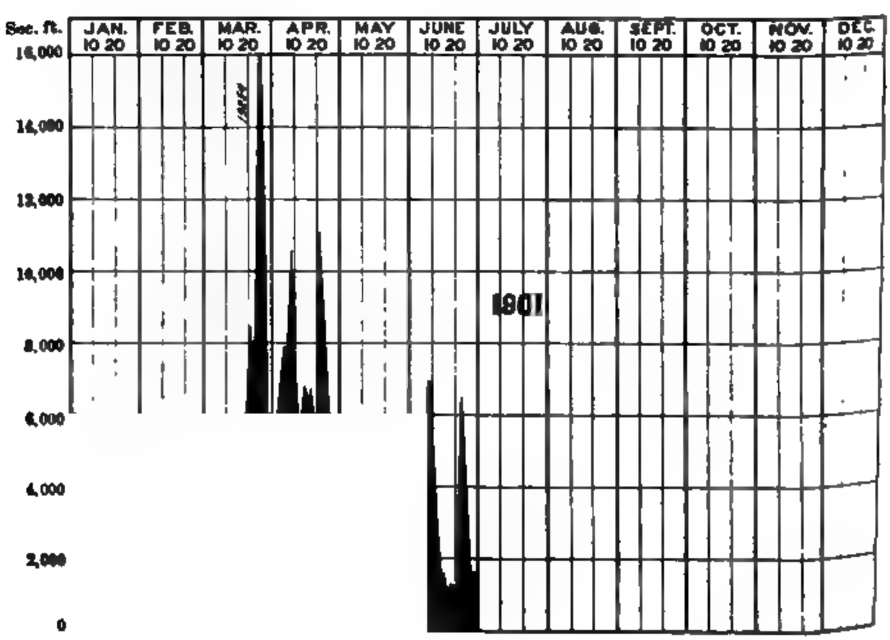

Fig. No. 68.—Discharge of Mohawk River at Little Falls, Herkimer County, N. Y., 19[illegible]

While the record has been kept at Little Falls, the following extreme freshets have occurred:

DATE.	Discharge, second-feet.	Second-feet per square mile.
April 15, 1899	13,000	10.0
April 20, 1900	15,240	11.7
November 27, 1900	15,669	12.0
March 27, 1901	19,538	14.9
December 16, 1901	26,260	20.1

The highest recorded previous flood occurred in February, 1891, when the estimated discharge was 26,260 second-feet.

The most notable low-water period was August 3 to August 10, inclusive, 1899, the mean flow for nine days being but 120 second-feet, or 0.07 second-feet per square mile. This was due to the almost complete diversion of the run-off above to supply Erie Canal.

MOHAWK RIVER AT ROCKY RIFT DAM, HERKIMER COUNTY, NEW YORK.

Five Mile or Rocky Rift Dam is a State dam used during the navigation season to divert water to Erie Canal. When the canal is closed the entire flow of Mohawk River passes over this dam. During the summer flashboards are maintained on the crest. These are carried off in the winter by ice and high water. The crest of the dam is straight and nearly level. The discharge during the high-water season of the winter of 1901 has been calculated from gauge readings taken in connection with slope gaugings of Mohawk River, described elsewhere. The flow over the crest has been calculated from experiments at Cornell University on a model dam of similar cross-section. The maximum discharge recorded was on March 21, 1901, and is estimated to have been 23,150 second-feet, or 17.2 second-feet per square mile from the tributary drainage area of 1,337 square miles.

Mean Daily Flow in Second-Feet of Mohawk River at Rocky Rift Dam, N. Y.

[Drainage area, 1,[illegible] square miles.]

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1912.												
1			[illegible]	[illegible]								
2			[illegible]	[illegible]								
3			[illegible]	[illegible]								
4			[illegible]	[illegible]								
5			[illegible]	[illegible]								
6			[illegible]	[illegible]								
7			[illegible]	[illegible]								
8			[illegible]	[illegible]								
9			[illegible]	[illegible]								
10			[illegible]	[illegible]								
11			[illegible]	[illegible]								
12			[illegible]	[illegible]								
13			[illegible]	[illegible]								
14			[illegible]	[illegible]								
15			[illegible]	[illegible]								
16			[illegible]	[illegible]								
17			[illegible]	[illegible]								
18			[illegible]	[illegible]								
19			[illegible]	[illegible]								
20			[illegible]	[illegible]								
21			[illegible]	[illegible]								
22		[illegible]	[illegible]	[illegible]								
23		[illegible]	[illegible]	[illegible]								
24		[illegible]	[illegible]	[illegible]								
25		[illegible]	[illegible]	[illegible]								
26		[illegible]	[illegible]	[illegible]								
27		[illegible]	[illegible]	[illegible]								
28		[illegible]	[illegible]	[illegible]								
29			[illegible]	[illegible]								
30			[illegible]	[illegible]								
31			[illegible]									
Mean		[illegible]	[illegible]	[illegible]								

[illegible] the following results:

Date.	Flow in second-feet.
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]

[illegible]

Fig. No. 69.—Timber Dam, Cayadutta Creek, at Gauging Station near Johnstown, Fulton County, N. Y.

Fig. No. 70.—Gauging Weir across Cayadutta Creek, below Johnstown, Fulton County, N. Y.

The profile of the crest of the dam is somewhat irregular, and, for facility of computation, it has been divided into four parts, the crest line of each section being assumed horizontal. Since the establishment of the station, standard sharp-crested gauging weirs have been erected for the company by Professor O. H. Landreth. One of these weirs has been placed across the main stream above the head of slack water from the dam. A second weir has been placed in the tailrace below the power-house. During the summer the water does not ordinarily flow over the dam, which is practically water-tight, the entire flow being passed through the turbines. A series of gaugings at the tailrace weir has been made in order to determine the discharging capacity of the water wheels when running under different conditions, and calibration curves so obtained for the wheels have been used in calculating the later records.

Mean Daily Flow in Second-feet of Cayadutta Creek near Johnstown, N. Y.

[Drainage area 40 square miles.]

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1898.												
1	......	......	......	......	......	......	......	......	......	24	41	39
2	......	......	......	......	......	......	......	......	......	10*	36	43
3	......	......	......	......	......	......	......	......	......	22	33	46
4	......	......	......	......	......	......	......	......	......	25	32	51*
5	......	......	......	......	......	......	......	......	......	119	39	33
6	......	......	......	......	......	......	......	......	......	246	12*	51
7	......	......	......	......	......	......	......	......	......	67	32	30
8	......	......	......	......	......	......	......	......	......	56	35	39
9	......	......	......	......	......	......	......	......	......	14*	179	38
10	......	......	......	......	......	......	......	......	......	37	784	33
11	......	......	......	......	......	......	......	......	......	28	429	25*
12	......	......	......	......	......	......	......	......	......	27	110	46
13	......	......	......	......	......	......	......	......	......	33	64*	37
14	......	......	......	......	......	......	......	......	......	28	68	36
15	......	......	......	......	......	......	......	......	......	290	55	33
16	......	......	......	......	......	......	......	......	......	117*	49	32
17	......	......	......	......	......	......	......	......	......	68	57	34
18	......	......	......	......	......	......	......	......	......	47	57	27*
19	......	......	......	......	......	......	......	......	......	46	97	33
20	......	......	......	......	......	......	......	......	......	39	67*	35
21	......	......	......	......	......	......	......	......	......	47	67	45
22	......	......	......	......	......	......	......	......	......	55	50	58
23	......	......	......	......	......	......	......	......	......	105*	54	98
24	......	......	......	......	......	......	......	......	......	56	68	67
25	......	......	......	......	......	......	......	......	......	48	55	60*
26	......	......	......	......	......	......	......	......	......	36	42	75
27	......	......	......	......	......	......	......	......	......	58	24*	42
28	......	......	......	......	......	......	......	......	......	55	46	31
29	......	......	......	......	......	......	......	......	......	138	59	34
30	......	......	......	......	......	......	......	......	......	18*	42	50
31	......	......	......	......	......	......	......	......	......	41	......	44
Mean	......	......	......	......	......	......	......	......	......	64	91	44

*Sundays.

Mean Daily Flow in Second-feet of Cayadutta Creek near Johnstown, N. Y.—(Concluded).

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec
1899.												
1		27		72	57	30	31	20	16	12*	33	19
2		35		70*	44	28	19*	22	20	34	31	.....
3		29		88	36	28	24	33	13*	34	28	14*
4		36		122	33	17*	17	22	19	35	48	37
5		19*		252	38	29	20	21	30	17	34*	27
6		29		263	27	28	20	11*	16	15	36	23
7		28		313	19*	18	19	19	28	19	28	28
8		19		303	29	30	34	20	23	9*	26	24
9		18		320*	38	31	19*	20	17	18	28	24
10		18		418	25	19	27	20	7*	20	27	13*
11		20		579	37	18*	25	17	18	34	26	27
12		14*		416	47	30	16	36	19	33	20*	230
13		19		611	29	35	18	8*	20	13	36	207
14		21		751	81*	34	16	20	17	20	28	143
15		34		303	25	25	18	20	19	17*	30	55
16		35		218*	28	35	19*	29	20	34	30	40
17		36		190	64	35	23	20	11*	26	21	44*
18		27		196	38	17*	25	20	19	33	30	36
19		19*		235	43	35	36	19	20	21	6*	51
20		23		168	47	37	20	9*	21	.....	27	45
21		33		135	34*	33	19	15	30	.....	27	53
22		65		143	34	33	28	16	17	.....*	26	43
23		91		122*	30	34	8*	14	19	.....	25	36
24		39		41	31	33	16	16	14*	....	24	19*
25		40		65	38	18*	22	16	20	21	26	56
26		40*		66	25	30	19	14	22	18	14*	60
27		[illegible]		44	30	36	16	11*	34	18	30	25
28		[illegible]		59	15*	30	17	15	26	19	28	23
29		.....		60	32	30	17	16	27	16*	23	27
30		.....		81*	18	23	14*	16	26	30	15	19
31		.....		.....	30	.....	35	16	.....	30	.....	11*
Mean	29	31	74	251	31	26	20	18	20	21	26	40
1900.												
1	27	38	41	350*	33	36	6*	12	11	.....	.....	.....
2	27	29	42	292	35	22	14	22	7*	.....	.....	.....
3	25	33	44	339	25	8*	20	30	21	.....	.....	.....
4	20	20*	28*	312	26	30	4	18	17	.....	.....	.....
5	18	261	55	199	30	36	15	7*	17	.....	.....	.....
6	20	48	41	280	24*	25	15	20	17	.....	.....	.....
7	24*	42	50	293	30	23	15	20	17	.....	.....	.....
8	60	148	46	156*	25	24	7*	20	31	.....	.....	.....
9	39	235	45	102	61	33	31	23	8*	.....	.....	.....
10	42	76	49	78	63	18*	19	13	21	.....	.....	.....
11	37	87*	39*	77	30	29	18	14	20	.....	.....	.....
12	31	116	66	91	34	29	20	4*	8	.....	.....	.....
13	30	1,404	48	106	19*	16	23	37	7	.....	.....	.....
14	14*	69	40	78	33	21	18	28	18	.....	.....	.....
15	35	77	41	91*	36	29	12*	29	16	.....	.....	.....
16	37	59*	39	133	38	22	19	34	9*	.....	.....	.....
17	29	46	41	200	36	8*	20	35	19	.....	.....	.....
18	40	25*	19*	314	29	24	18	33	21	.....	.....	.....
19	92	42	42	164	36	24	17	10*	19	.....	.....	.....
20	705	41	45	102	32*	34	14	16	31	.....	.....	.....
21	506*	39	57	76	25	22	19	21	21	.....	.....	.....
22	101	44	62	116*	34	31	7*	20	21	.....	.....	.....
23	83	107	111	92	19	17	15	21	14*	.....	.....	.....
24	55	97	62	80	22	10*	18	22	22	.....	.....	.....
25	71	41*	52*	71	23	17	17	23	23	.....	.....	.....
26	50	60	46	64	26	19	26	7*	[illegible]	.....	.....	.....
27	43	43	50	46	19*	14	25	20	21	.....	.....	.....
28	23*	30	49	46	22	17	24	18	23	.....	.....	.....
29	44	.....	106	32*	19	19	13*	20	23	.....	.....	.....
30	36	.....	165	25	30	18	13	20	10*	.....	.....	.....
31	31	.....	296	.....	23	.....	13	18	.....	.....	.....	.....
Mean	71	119	63	137	27	21	17	20	18	.....	.....	.....

* Sundays.

(See Water Supply and Irrigation Paper, U. S. G. S., No. 35, page 53.)

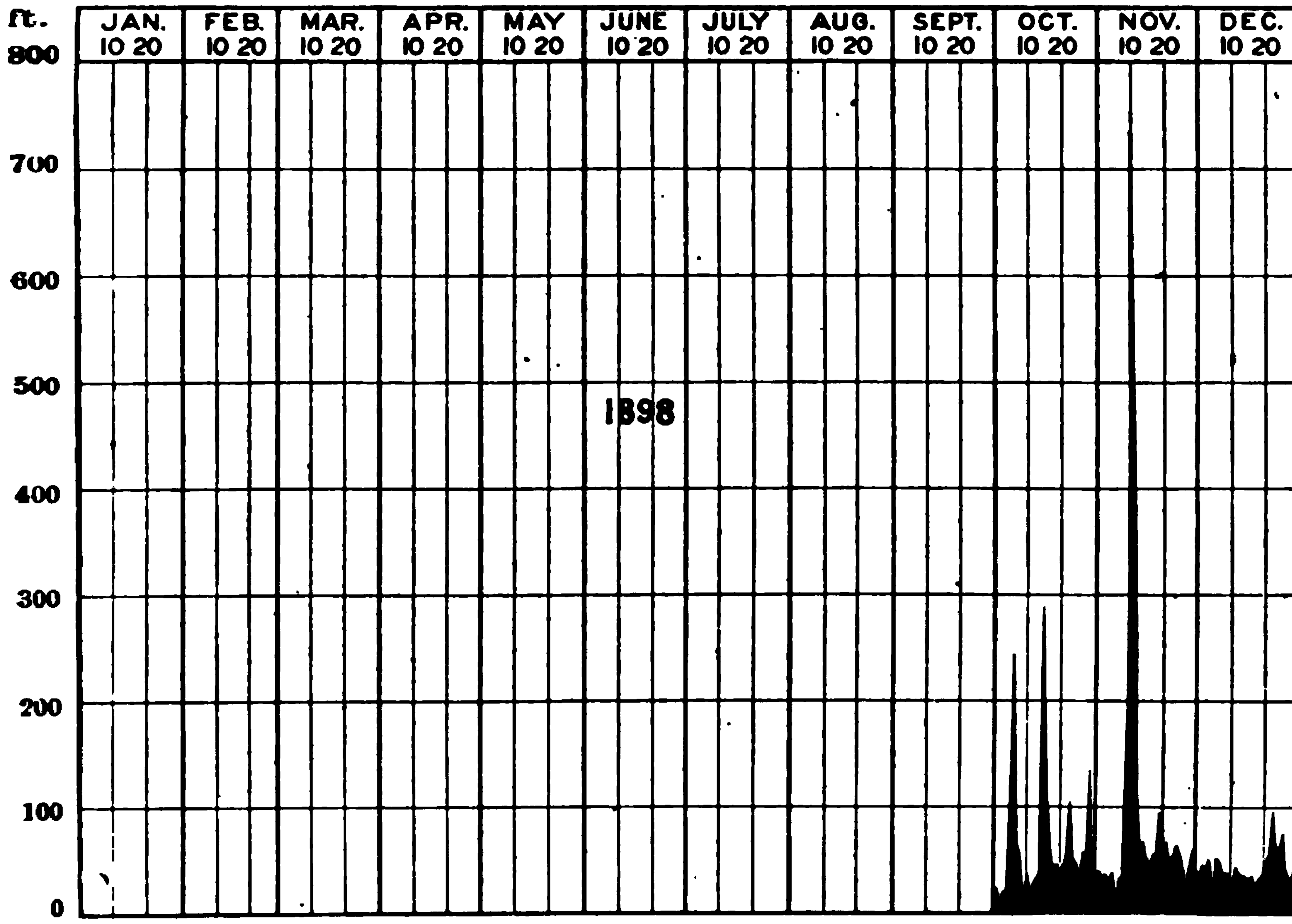

Fig. No. 71.—Discharge of Cayadutta Creek at Johnstown, Fulton County, N. Y., 1898.

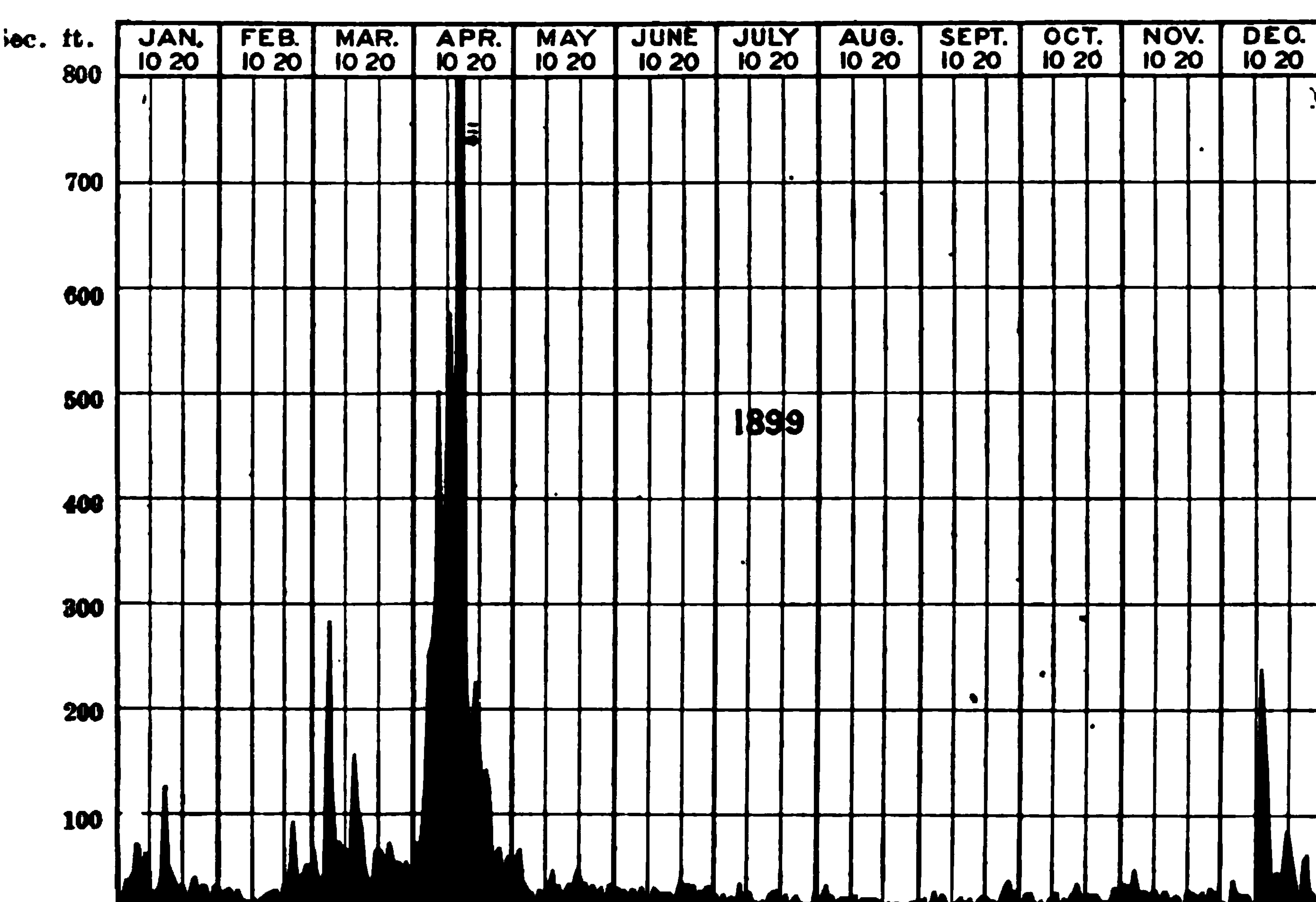

Fig. No. 72.—Discharge of Cayadutta Creek at Johnstown, Fulton County, N. Y., 1899.

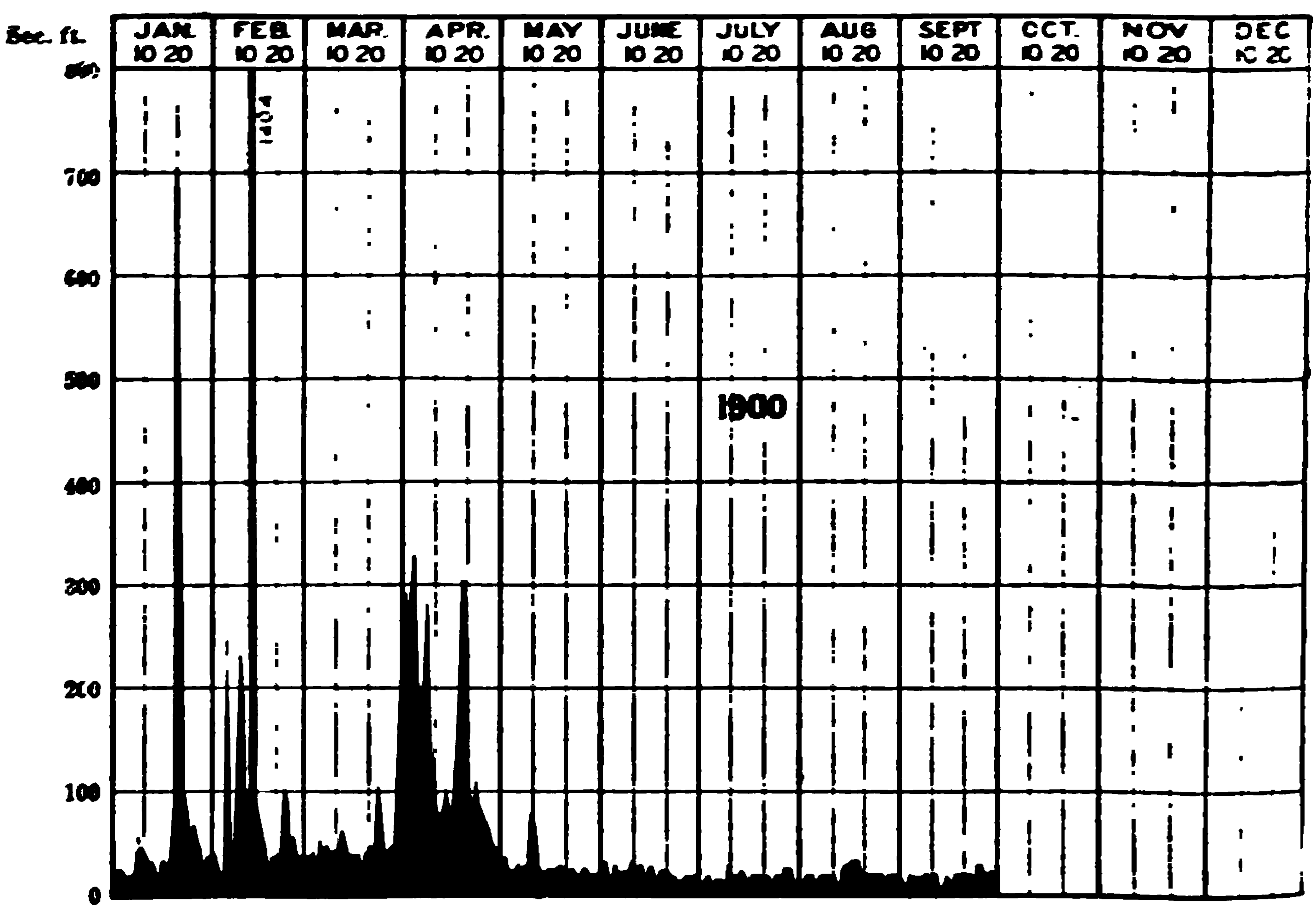

Fig. No. 73.—Discharge of Cayadutta Creek at Johnstown, Fulton County, N. Y., 1900.

Dams are located along the stream at frequent intervals and the amount of flow, from one to another, during the dry season, is largely controlled by the run of the water wheels. The drainage area tributary to Cayadutta Creek, above the gauging station, is 40 square miles, and above its mouth 62 square miles.

Mean Monthly Run-off of Cayadutta Creek near Johnstown, Fulton County, N. Y.

[Drainage area 40 square miles.]

MONTH.	SECOND-FEET.			SECOND-FEET PER SQUARE MILE.			INCHES ON DRAINAGE AREA.		
	1898.	1899.	1900.	1898.	1899.	1900.	1898.	1899.	1900.
January	....	39	71	....	0.97	1.77	....	1.12	2.04
February	....	31	119	....	0.77	2.97	....	0.80	3.09
March	....	74	62	....	1.85	1.55	....	2.13	1.78
April	....	251	137	....	6.27	3.50	....	7.00	3.90
May	....	31	27	....	0.77	0.67	....	0.89	0.77
June	....	26	21	....	0.65	0.52	....	0.72	0.58
July	....	20	17	....	0.50	0.42	....	0.57	0.48
August	....	18	20	....	0.45	0.50	....	0.52	0.57
September	....	20	18	....	0.50	0.45	....	0.56	0.50
October	64	21	....	1.60	0.52	....	1.84	0.60	....
November	91	26	....	2.27	0.65	....	2.53	0.72	....
December	44	49	....	1.10	1.22	....	1.27	1.40	....

SCHOHARIE CREEK AT FORT HUNTER DAM AND AQUEDUCT, MONTGOMERY COUNTY, N. Y.

Schoharie Creek finds its origin in the western slope of the Catskill Mountains. The lower stretches of the creek flow through a long, flat valley in a stream channel covered with riprap, over which the water finds its way in a thin sheet during the dry season.

The State dam at Fort Hunter is near the mouth of the stream, and high water from the Mohawk backs up to the toe of the dam. A record of the elevation of water surface in the pond above the dam has been made. A similar record of the elevation of the water surface below the dam shows the average difference or fall to be 5.25 feet. This quantity is nearly constant except when the water falls below the crest level above the dam or when the height of the down-stream side is affected by backwater. The dam is of timber, backed with gravel, and there are a number of leaks above the gravel line

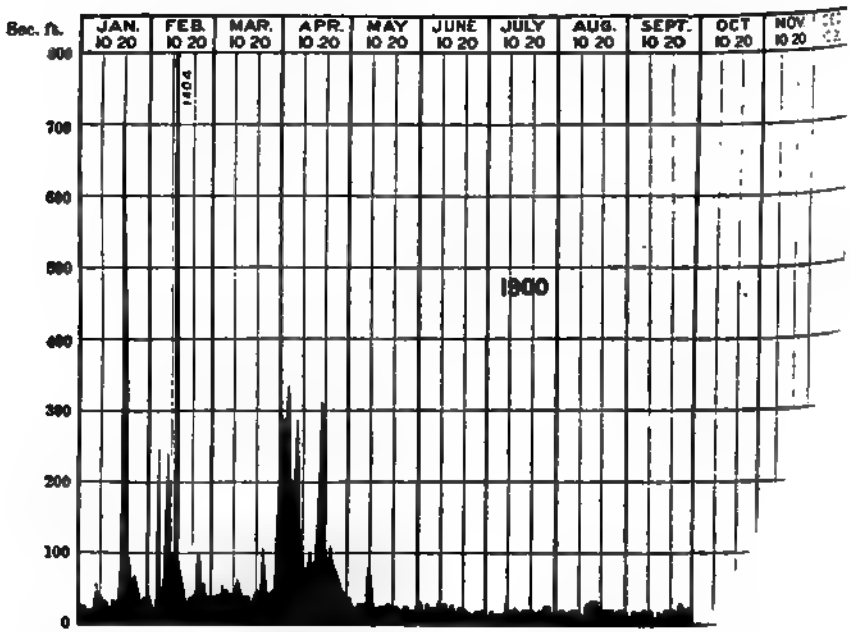

Fig. No. 73.—Discharge of Cayadutta Creek at Johnstown, Fulton

at an elevation of two feet below that of the crest. During the summer, diversion through the canal feeder keeps the water level below that of the dam crest, hence the leakage of the dam represents practically the total inflow from Schoharie Creek to the Mohawk during the low-water season. Current meter measurements of the leakage of the dam were made below the Erie Canal aqueduct at a point where the entire flow is concentrated in a narrow channel.

DATE.	Hydrographer.	Measured leakage, second-feet.
June 26, 1900	R. E. Horton	30
July 18, 1900	E. D. Walker	35
August 22, 1900	E. D. Walker	44

The leakage of the dam has been assumed constantly equal to 35 second-feet in computing the record. The Fort Hunter station was established September 24, 1898. The intention was to maintain a record of the water height above and below the head-gates at the entrance to the canal feeder, from which the effective head on the gate openings could be determined and the flow computed by the formula for submerged orifices. During the dry season the water falls below the lip of the gates and flows in an open channel, making this method inapplicable. In recomputing the record, the diversion to the canal feeder has been estimated from current meter measurement as follows:

DATE.	Hydrographer.	Measured flow in feeder, second-feet.
June 21, 1900	R. E. Horton	112
July 18, 1900	E. D. Walker	76
August 22, 1900	E. D. Walker	73

Inflow to the Erie Canal is controlled by gates at the lower end of the feeder channel, so that the flow in the feeder is not directly a function of the stage of the water. Owing to the uncertainty of the low water measurements, this station was abandoned July 31, 1900. It was again resumed October 1,

Fig. No. 74.—Fort Hunter Dam on Schoharie Creek, Montgomery County, N. Y., during low water.

1900, and maintained during the winter of 1900 and 1901, in connection with the Barge Canal Survey. The record for the winter months of 1900 and 1901, when no diversion to the canal took place, is included in the accompanying tables.[a]

The tables given show the total outgo from the pond above the State dam. As pointed out, the greater portion of this flow during the navigation season goes into Erie Canal. During the winter the entire flow is tributary to Mohawk River. A rough meter measurement above Fort Hunter Dam, April 24, 1900, showed the discharge to be 5,573 second-feet.

The Erie Canal crosses Schoharie Creek between Fort Hunter dam and Mohawk River. A gauging record was established at the aqueduct May 2, 1900, by Prof. Elton D. Walker. A current meter measurement of the flow through the archways of the canal aqueduct, made at that time, showed a discharge of 1,257 second-feet; gauge height, 2.26 feet. A similar measurement of the discharge at this point October 25, 1898, by W. D. Lockwood, gave a discharge of 1,015 second-feet. Owing to cross currents above the aqueduct, it was found impossible to secure reliable gaugings, and the station was abandoned October 13, 1900. The locations of the Fort Hunter and aqueduct gauging stations are shown on the Fonda sheet of the U. S. Geological Survey.

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a The tables of flow, as computed from the earlier portion of the record, allowing 315 second-feet for leakage, may be found in Water Supply and Irrigation Paper No. 35, p. 58.

Daily Gauge Height of Schoharie Creek at Fort Hunter.

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1900.												
1	......	......	......	......	......	1.88	0.60	0.67	0.54	0.53	......	......
2	......	......	......	......	2.24	1.47	.62	.65	.53	.54	......	......
3	......	......	......	......	2.20	1.76	.58	.61	.54	.51	......	......
4	......	......	......	......	2.14	1.62	.60	.63	.53	.53	......	......
5	......	......	......	......	2.10	0.94	.60	.62	.54	.58	......	......
6	......	......	......	......	2.00	0.95	.57	.61	.54	.61	......	......
7	......	......	......	......	1.10	0.87	.56	.52	.53	.62	......	......
8	......	......	......	......	2.00	0.90	.50	.52	.54	.53	......	......
9	......	......	......	......	1.97	1.90	.48	.51	.64	.54	......	......
10	......	......	......	......	2.00	1.84	.52	.50	.64	.52	......	......
11	......	......	......	......	1.10	1.80	.60	.52	.65	.59	......	......
12	......	......	......	......	1.97	1.40	.63	.58	.63	.56	......	......
13	......	......	......	......	1.69	1.68	.64	.52	.63	.57	......	......
14	......	......	......	......	1.76	1.40	.60	.57	.64	......	......	......
15	......	......	......	......	1.70	1.13	.54	.54	.63	......	......	......
16	......	......	......	......	1.67	1.2	.53	.53	.64	......	......	......
17	......	......	......	......	1.58	0.82	.58	1.43	.65	......	......	......
18	......	......	......	......	1.52	.71	.56	1.32	.63	......	......	......
19	......	......	......	......	1.47	.82	.60	1.92	.63	......	......	......
20	......	......	......	......	1.98	.70	.61	0.97	.65	......	......	......
21	......	......	......	......	2.64	.72	.68	.78	.65	......	......	......
22	......	......	......	......	2.43	.70	.65	.71	.63	......	......	......
23	......	......	......	......	2.14	.67	.62	.66	.64	......	......	......
24	......	......	......	......	1.93	.60	.68	.64	.62	......	......	......
25	......	......	......	......	1.87	.60	.71	.63	.53	......	......	......
26	......	......	......	......	1.80	.60	.73	.54	.56	......	......	......
27	......	......	......	......	1.67	.60	.78	.53	.57	......	......	......
28	......	......	......	......	1.40	.62	.72	.54	.53	......	......	......
29	......	......	......	......	1.47	.61	.60	.53	.52	......	......	......
30	......	......	......	......	1.45	.60	.63	.53	.53	......	......	......
31	......	......	......	......	1.40	......	.64	.54	......	......	......	......

Mean Monthly Run-off of Schoharie Creek at Fort Hunter.

MONTH.	SECOND-FEET.				SECOND-FEET PER SQUARE MILE.				INCHES ON DRAINAGE AREA.			
	1898.	1899.	1900.	1901.	1898.	1899.	1900.	1901.	1898.	1899.	1900.	1901.
January	......	2,307	1,313	998	......	2.44	1.88	1.06	......	2.81	1.59	1.22
February	......	1,944	......	1,393	......	2.05	......	1.48	......	2.13	......	1.56
March	......	3,792	3,137	4,348	......	4.01	3.31	4.61	......	4.62	3.81	5.30
April	......	4,100	3,530	7,165	......	4.33	3.73	7.59	......	4.83	4.16	8.50
May	......	579	561	......	......	0.61	0.59	......	......	0.70	0.68	......
June	......	226	219	......	......	0.24	0.23	......	......	0.26	0.25	......
July	......	187	115	......	......	0.20	0.12	......	......	0.23	0.14	......
August	......	142	......	......	......	0.15	......	......	......	0.17	......	......
September	129	916	......	......	0.14	0.97	......	......	0.15	1.08	......	......
October	1,142	1,603	......	......	1.21	1.69	......	......	1.36	1.95	......	......
November	2,148	875	......	......	2.27	0.92	......	......	2.53	1.02	......	......
December	1,573	......	950	......	1.66	......	1.01	......	1.91	......	1.16	......

Mean Daily Flow in Second-feet, Schoharie Creek, at Fort Hunter, N. Y.

[Drainage area, 947 square miles.]

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1898.												
1	......	......	......	......	......	......	......	......	......	161	1,617	1,139
2	......	......	......	......	......	......	......	......	......	161	1,717	939
3	......	......	......	......	......	......	......	......	......	161	917	1,839
4	......	......	......	......	......	......	......	......	......	161	917	1,439
5	......	......	......	......	......	......	......	......	......	1,661	767	1,839
6	......	......	......	......	......	......	......	......	......	3,211	767	1,639
7	......	......	......	......	......	......	......	......	......	1,361	847	1,839
8	......	......	......	......	......	......	......	......	......	791	767	1,839
9	......	......	......	......	......	......	......	......	......	1,761	667	1,739
10	......	......	......	......	......	......	......	......	......	791	5,067	1,239
11	......	......	......	......	......	......	......	......	......	611	9,517	939
12	......	......	......	......	......	......	......	......	......	611	5,767	1,639
13	......	......	......	......	......	......	......	......	......	591	2,917	1,539
14	......	......	......	......	......	......	......	......	......	1,661	2,967	1,639
15	......	......	......	......	......	......	......	......	......	2,136	2,417	1,539
16	......	......	......	......	......	......	......	......	......	2,461	1,817	1,639
17	......	......	......	......	......	......	......	......	......	711	1,517	1,389
18	......	......	......	......	......	......	......	......	......	791	1,517	1,539
19	......	......	......	......	......	......	......	......	......	861	2,417	859
20	......	......	......	......	......	......	......	......	......	791	3,967	689
21	......	......	......	......	......	......	......	......	......	791	2,842	814
22	......	......	......	......	......	......	......	......	......	791	2,067	1,639
23	......	......	......	......	......	......	......	......	......	1,061	1,967	2,639
24	......	......	......	......	......	......	......	......	129	861	1,967	2,089
25	......	......	......	......	......	......	......	......	129	861	1,517	3,289
26	......	......	......	......	......	......	......	......	129	861	1,517	814
27	......	......	......	......	......	......	......	......	129	1,861	1,217	1,539
28	......	......	......	......	......	......	......	......	129	2,261	917	1,539
29	......	......	......	......	......	......	......	......	129	1,911	767	939
30	......	......	......	......	......	......	......	......	129	1,561	767	1,239
31	......	......	......	......	......	......	......	......	......	1,661	......	3,864
Mean	......	......	......	......	......	......	......	......	129	1,142	2,148	1,578
1899.												
1	1,741	1,651	4,915	1,335	1,515	295	182	148	148	3,867	935	......
2	1,641	1,351	3,655	1,335	1,460	295	178	152	148	1,967	1,615	......
3	1,641	1,651	3,165	1,335	1,560	395	152	145	145	1,767	1,515	......
4	941	1,251	2,935	2,135	1,140	395	182	138	145	2,247	935	......
5	5,791	1,251	6,635	2,785	860	295	185	142	148	2,467	935	......
6	4,791	951	13,635	3,185	860	295	185	145	148	1,967	765	......
7	3,541	951	6,235	3,655	710	295	190	148	148	1,767	935	......
8	3,141	851	3,485	7,685	585	225	195	138	142	1,547	935	......
9	3,541	901	2,935	5,335	585	205	198	138	152	1,767	785	......
10	2,241	901	3,535	3,655	610	195	185	135	152	967	765	......
11	1,991	851	4,085	4,535	440	195	182	138	152	967	935	......
12	1,641	851	7,685	5,735	440	195	190	138	148	1,517	1,615	......
13	1,841	657	11,185	7,685	340	195	198	132	148	1,547	1,835	......
14	1,841	701	4,455	7,635	260	195	202	132	145	1,967	1,515	......
15	2,091	801	3,175	9,335	260	195	202	135	145	1,547	1,515	......
16	2,341	951	2,685	7,685	340	195	198	138	142	2,247	935	......
17	3,291	951	2,285	5,215	490	195	202	138	138	967	935	......
18	2,741	1,551	2,085	4,085	585	195	202	138	145	797	765	......
19	2,291	1,751	2,335	4,385	510	195	195	142	145	587	765	......
20	2,341	1,551	2,515	3,812	585	195	195	145	148	967	765	......
21	1,991	3,151	2,775	3,582	585	195	190	142	148	797	635	......
22	1,641	2,876	2,775	2,842	510	195	185	148	148	587	635	......
23	1,541	3,407	2,775	3,532	440	195	185	148	148	967	453	......
24	1,541	3,726	2,685	3,342	340	195	165	142	148	797	453	......
25	2,741	3,726	2,515	3,198	340	195	198	145	152	1,967	515	......
26	1,991	4,301	2,335	3,838	260	195	190	148	182	1,767	455	......
27	2,091	4,885	2,085	2,633	260	195	185	142	6,984	2,147	425	......
28	1,841	6,085	2,185	2,698	260	195	182	148	6,126	1,547	835	......
29	1,541	......	1,485	2,298	340	195	190	145	5,740	1,967	835	......
30	1,641	......	1,385	2,948	260	195	190	148	4,790	2,147	295	......
31	1,541	......	1,435	......	260	......	190	145	......	1,547	......	......
Mean	2,307	1,944	3,792	4,100	579	226	187	142	916	1,603	[illegible]	......

Mean Daily Flow in Second-feet, Schoharie Creek at Fort Hunter, N. Y.—(Concluded).

DAY.	Jan.	Feb.*	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1900.												
1	735	......	3,465	2,915	885	360	111	......	......	......	......	[illegible]
2	[illegible]	......	[illegible]	2,[illegible]75	985	135	102	......	......	......	......	[illegible]
3	[illegible]	......	7,515	3,[illegible]	535	345	102	......	......	......	......	[illegible]
4	[illegible]	......	6,795	3,[illegible]	985	345	111	......	......	......	......	[illegible]
5	[illegible]	......	5,565	3,335	1,2[illegible]	254	90	......	......	......	......	[illegible]
6	[illegible]	......	2,455	[illegible]	49[illegible]	233	76	......	......	......	......	[illegible]
7	4[illegible]5	......	3,[illegible]	3,[illegible]	412	2[illegible]2	76	......	......	......	......	[illegible]
8	[illegible]	......	3,[illegible]	2,[illegible]	439	342	76	......	......	......	......	[illegible]
9	[illegible]	......	[illegible]	2,495	315	515	135	......	......	......	......	[illegible]
10	41[illegible]	......	2,7[illegible]	2,[illegible]	519	2[illegible]	14[illegible]	......	......	......	......	[illegible]
11	3[illegible]5	......	[illegible]55	2,[illegible]5	472	360	145	......	......	......	......	[illegible]
12	[illegible]5	......	3,[illegible]5	2,[illegible]5	39[illegible]	316	140	......	......	......	......	[illegible]
13	455	......	2,[illegible]5	2,275	[illegible]	306	135	......	......	......	......	[illegible]
14	575	......	2,[illegible]55	2,915	2[illegible]3	257	127	......	......	......	......	[illegible]
15	4[illegible]	......	2,[illegible]	2,9[illegible]5	312	29[illegible]	123	......	......	......	......	[illegible]
16	5[illegible]5	......	2,[illegible]5	3,535	327	29[illegible]	115	......	......	......	......	[illegible]
17	375	......	[illegible]	4,735	319	235	118	......	......	......	......	[illegible]
18	[illegible]	......	[illegible]35	6,[illegible]35	3[illegible]2	22[illegible]	[illegible]	......	......	......	......	[illegible]
19	2,[illegible]	......	[illegible]35	4,[illegible]5	[illegible]	[illegible]	[illegible]	......	......	......	......	[illegible]
20	4,[illegible]	......	[illegible]5	4,[illegible]5	1,[illegible]	153	[illegible]	......	......	......	......	[illegible]
21	[illegible]	......	[illegible]5	5,[illegible]5	1,55[illegible]	147	106	......	......	......	255	[illegible]
22	4,[illegible]	......	2,[illegible]	4,[illegible]5	1,[illegible]	143	72	......	......	......	55	[illegible]
23	[illegible]	......	1,755	6,[illegible]5	5[illegible]	[illegible]9	122	......	......	......	35	[illegible]
24	[illegible]	......	2,495	5,[illegible]5	412	[illegible]9	[illegible]	......	......	......	255	[illegible]
25	1,[illegible]25	......	2,[illegible]	4,[illegible]5	469	[illegible]9	144	......	......	......	......	3,[illegible]
26	[illegible]5	......	2,95[illegible]	3,[illegible]5	315	[illegible]6	1[illegible]5	......	......	......	455	2,[illegible]
27	735	......	2,495	[illegible]5	3[illegible]5	[illegible]3	[illegible]	......	......	......	5,[illegible]	1,[illegible]
28	4[illegible]5	......	2,[illegible]5	2,4[illegible]5	2[illegible]	[illegible]	[illegible]	......	......	......	2,595	[illegible]
29	[illegible]	......	3,[illegible]5	1,[illegible]5	[illegible]	12[illegible]	[illegible]	......	......	......	1,[illegible]5	[illegible]
30	4[illegible]5	......	3,[illegible]5	1,325	5[illegible]	122	[illegible]	......	......	......	1,[illegible]5	[illegible]
31	4[illegible]	......	3,[illegible]5	......	360	......	11[illegible]	......	......	......	......	[illegible]
Mean	1,[illegible]	......	3,[illegible]	3,530	56[illegible]	219	125	......	......	......	1,[illegible]	95[illegible]
1901.												
1	955	1,075	4,275	1,325	......	......	......	......	......	......	......	......
2	555	1,[illegible]75	4,2[illegible]5	1,[illegible]	......	......	......	......	......	......	......	......
3	[illegible]5	1,[illegible]	4,[illegible]	1,[illegible]	......	......	......	......	......	......	......	......
4	[illegible]	1,[illegible]	4,[illegible]5	2,955	......	......	......	......	......	......	......	......
5	[illegible]95	1,[illegible]5	4,[illegible]	6,[illegible]	......	......	......	......	......	......	......	......
6	[illegible]5	1,[illegible]	2,[illegible]5	6,595	......	......	......	......	......	......	......	......
7	[illegible]5	1,[illegible]5	1,[illegible]	1[illegible]5	......	......	......	......	......	......	......	......
8	[illegible]5	1,[illegible]5	1,[illegible]	[illegible]	......	......	......	......	......	......	......	......
9	935	2,[illegible]55	1,[illegible]	7,[illegible]	......	......	......	......	......	......	......	......
10	[illegible]5	2,[illegible]55	2,[illegible]	4,[illegible]	......	......	......	......	......	......	......	......
11	1,[illegible]	2,[illegible]5	3,[illegible]5	4,[illegible]	......	......	......	......	......	......	......	......
12	1,[illegible]	2,[illegible]5	[illegible]	3,[illegible]	......	......	......	......	......	......	......	......
13	1,[illegible]5	1,[illegible]	4,9[illegible]	3,[illegible]5	......	......	......	......	......	......	......	......
14	1,[illegible]5	1,[illegible]5	3,[illegible]	3,435	......	......	......	......	......	......	......	......
15	1,[illegible]5	1,[illegible]5	4,2[illegible]5	3,455	......	......	......	......	......	......	......	......
16	[illegible]5	1,[illegible]5	4,[illegible]55	3,[illegible]	......	......	......	......	......	......	......	......
17	[illegible]	1,[illegible]	3,[illegible]	2,[illegible]	......	......	......	......	......	......	......	......
18	[illegible]	735	3,[illegible]	2,[illegible]	......	......	......	......	......	......	......	......
19	[illegible]	465	5,[illegible]	2,465	......	......	......	......	......	......	......	......
20	[illegible]	1,[illegible]	6,[illegible]5	2,[illegible]5	......	......	......	......	......	......	......	......
21	[illegible]	1,[illegible]	[illegible]	[illegible]	......	......	......	......	......	......	......	......
22	[illegible]	3,[illegible]5	[illegible]	[illegible]	......	......	......	......	......	......	......	......
23	1,[illegible]5	1,[illegible]5	3,[illegible]	[illegible]4,455	......	......	......	......	......	......	......	......
24	[illegible]5	1,[illegible]5	3,[illegible]	9,[illegible]5	......	......	......	......	......	......	......	......
25	[illegible]5	1,[illegible]	5,[illegible]	[illegible]	......	......	......	......	......	......	......	......
26	[illegible]	[illegible]5	7,4[illegible]5	[illegible]	......	......	......	......	......	......	......	......
27	[illegible]	[illegible]	[illegible]	6,[illegible]5	......	......	......	......	......	......	......	......
28	1,[illegible]	735	5,[illegible]	......	......	......	......	......	......	......	......	......
29	[illegible]	......	2,[illegible]	......	......	......	......	......	......	......	......	......
30	[illegible]	......	[illegible]	......	......	......	......	......	......	......	......	......
31	1,[illegible]5	......	1,[illegible]5	......	......	......	......	......	......	......	......	......
Mean	99[illegible]	1,393	4,34[illegible]	7,165	......	......	......	......	......	......	......	......

* No record kept.

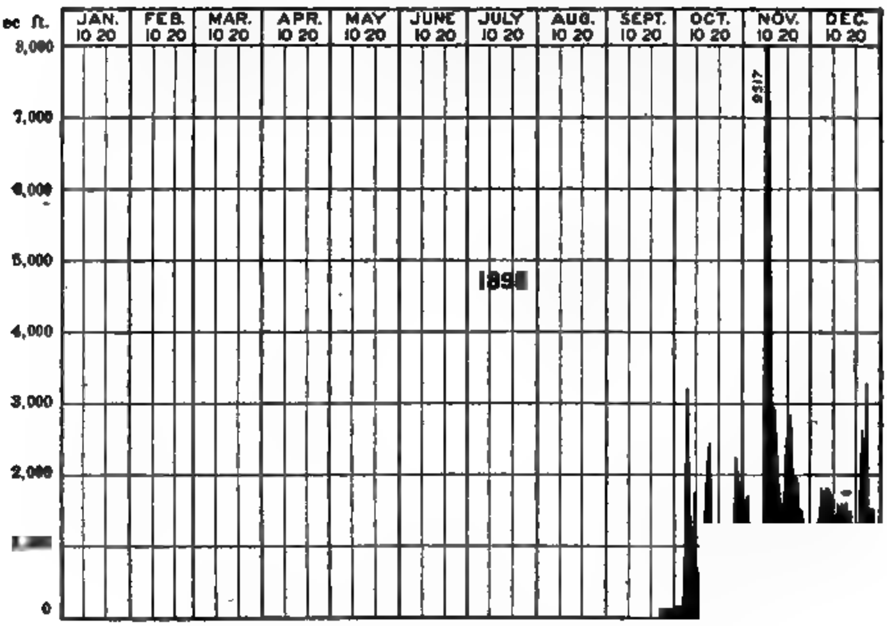


Fig. No. 75.—Discharge of Schoharie Creek at Fort Hunter, Montgomery County, N. Y., 1898.

Fig. No. 76.—Discharge of Schoharie Creek at Fort Hunter, Montgomery County, N. Y., 1899.

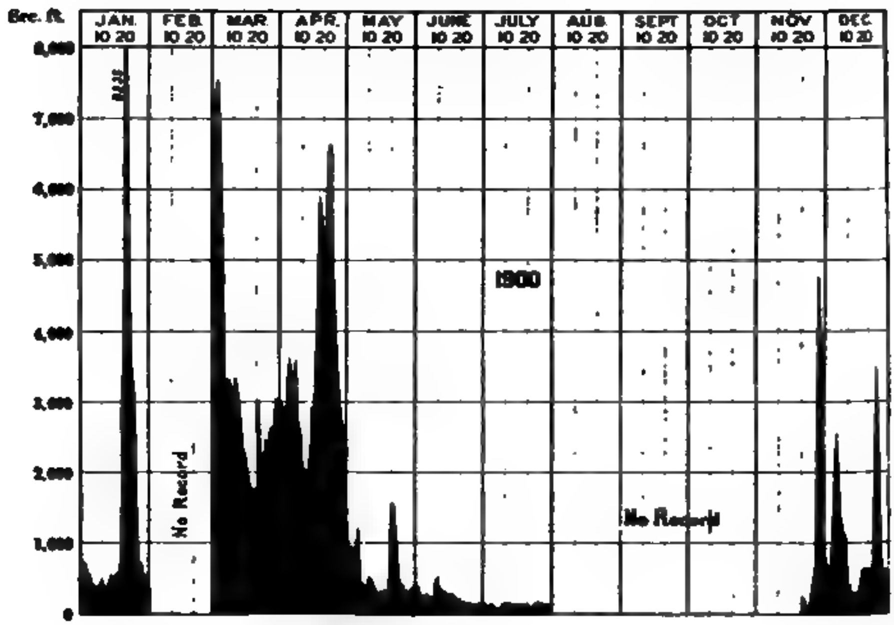


Fig. No. 77.—Discharge of Schoharie Creek at Fort Hunter, Montgomery County, N. Y., 1900

Sec. ft.
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0

Fig. No. 78.—Discharge of Schoharie Creek at Fort Hunter, Montgomery County, N. Y. 1901

SCHOHARIE CREEK AT MILL POINT, MONTGOMERY COUNTY, N. Y.

A current meter station was established at Mill Point highway bridge on July 5, 1900. The stream bed is stony and fairly permanent. The channel is of nearly constant width at all stages of the stream.

Daily Gauge Height, in feet, of Schoharie Creek at Mill Point, N. Y.

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1900.												
1	.....	.....	.....	.....	.....	.....	.....	0.65	0.35	0.50	0.55	2.10
2	.....	.....	.....	.....	.....	.....	.....	.65	.35	.50	.45	1.90
3	.....	.....	.....	.....	.....	.....	.....	.45	.35	.45	.60	1.80
4	.....	.....	.....	.....	.....	.....	.....	.40	.30	.40	.60	1.70
5	.....	.....	.....	.....	.....	.....	.....	.50	.25	.40	.50	3.02
6	.....	.....	.....	.....	.....	.....	0.60	.35	.22	.45	.40	2.60
7	.....	.....	.....	.....	.....	.....	.33	.40	.40	.35	.60	2.35
8	.....	.....	.....	.....	.....	.....	.70	.35	.30	.30	.60	2.25
9	.....	.....	.....	.....	.....	.....	.50	.30	.30	.15	.65	2.10
10	.....	.....	.....	.....	.....	.....	.80	.30	.25	.00	.85	1.80
11	.....	.....	.....	.....	.....	.....	.70	.40	.45	.00	.60	1.75
12	.....	.....	.....	.....	.....	.....	.70	.40	.45	.35	.60	1.75
13	.....	.....	.....	.....	.....	.....	.60	.45	.35	.45	.80	1.72
14	.....	.....	.....	.....	.....	.....	.60	.30	.35	.15	.90	1.70
15	.....	.....	.....	.....	.....	.....	.60	.25	.30	.30	.72	1.65
16	.....	.....	.....	.....	.....	.....	.65	.40	.35	.30	.70	1.60
17	.....	.....	.....	.....	.....	.....	.60	.95	.35	.40	.65	1.65
18	.....	.....	.....	.....	.....	.....	.65	1.45	.30	.45	.70	1.70
19	.....	.....	.....	.....	.....	.....	.65	.95	.35	.45	.75	1.82
20	.....	.....	.....	.....	.....	.....	.65	.72	.25	.45	.98	1.95
21	.....	.....	.....	.....	.....	.....	.60	.70	.00	.40	1.45	2.30
22	.....	.....	.....	.....	.....	.....	.95	.75	.00	.30	1.42	2.10
23	.....	.....	.....	.....	.....	.....	.90	.70	.00	.60	1.50	1.70
24	.....	.....	.....	.....	.....	.....	.80	.60	.30	.60	1.35	1.58
25	.....	.....	.....	.....	.....	.....	.85	.55	.35	.50	1.30	2.95
26	.....	.....	.....	.....	.....	.....	.80	.50	.30	.70	1.72	3.70
27	.....	.....	.....	.....	.....	.....	.80	.45	.30	.75	3.60	1.70
28	.....	.....	.....	.....	.....	.....	.80	.50	.35	.52	2.75	2.05
29	.....	.....	.....	.....	.....	.....	.70	.50	.45	.45	2.25	1.95
30	.....	.....	.....	.....	.....	.....	.70	.55	.45	.52	2.15	1.50
31	.....	.....	.....	.....	.....	.....	.65	.48	.....	.50	.....	1.60
1901.												
1	1.65	2.20	2.15	2.20	2.60	3.25	.90	.70	.90	.65	1.05	1.35
2	1.60	2.10	2.15	2.00	.... *a*	3.35	.85	.70	1.75	.70	1.0	1.5
3	1.55	2.20	2.15	2.10	.... *a*	3.45	.80	.65	1.60	.75	.90	1.45
4	1.45	2.20	2.15	3.00	.... *a*	3.05	.80	.60	1.50	.70	.90	1.55
5	1.40	2.20	2.15	4.02	.... *a*	2.55	.75	.60	1.45	.65	.85	1.6
6	1.35	2.20	2.15	3.72	.... *a*	1.95	.85	.60	1.30	.65	.55	1.6
7	1.45	2.20	2.15	6.25	.... *a*	1.90	1.55	.55	1.25	.60	.80	1.55
8	1.40	2.20	2.15	6.75	.... *a*	3.35	1.50	.70	1.1	.55	.75	1.5
9	1.40	2.20	2.20	4.50	.... *a*	2.50	1.40	.75	1.0	.55	.75	2.0
10	1.45	2.15	2.20	3.65	.... *a*	2.45	1.35	1.0	.8	.50	.70	3.37
11	1.40	2.15	2.25	.....	.... *a*	2.30	1.25	.95	.75	.45	.70	3.65
12	1.40	2.15	3.30	.....	3.10	2.05	1.20	.90	1.0	.40	.75	2.95
13	1.45	2.15	3.20	.....	3.58	1.80	1.20	.90	.9	.40	.95	2.5
14	1.40	2.15	2.80	3.20	2.80	1.50	1.20	.85	.85	2.50	1.0	3.6
15	1.50	2.15	2.10	3.25	2.35	1.85	1.15	.85	.85	2.30	1.0	11.7
16	1.75	2.15	2.00	3.30	2.15	1.35	1.10	.90	.85	2.10	1.1	5.1
17	1.80	2.15	1.75	3.20	2.85	1.35	1.10	.85	.95	2.0	1.15	4.1
18	1.85	2.15	1.60	3.25	2.50	1.30	1.30	.80	.9	1.90	1.15	2.8
19	1.80	2.15	1.85	3.20	2.70	1.25	1.65	.75	.85	1.80	1.20	2.0
20	1.90	2.15	2.10	3.25	2.80	1.20	1.55	.70	.85	1.80	1.30	2.0
21	2.05	2.15	3.82	7.60	2.75	1.15	1.35	2.07½	.85	1.80	1.25	1.95
22	2.10	2.15	4.67	8.80	2.50	1.00	1.15	1.45	.8	1.75	1.20	1.8
23	2.40	2.15	4.50	7.00	2.30	2.53	1.05	1.40	.8	1.40	1.15	1.8
24	2.30	2.15	4.15	7.75	2.20	2.50	.90	1.52½	.85	1.1	1.15	1.7
25	2.45	2.15	4.40	7.70	2.40	1.75	.85	2.20	.8	.85	1.10	1.7
26	2.30	2.15	4.70	.....	2.35	1.25	.80	1.85	.75	.70	1.0	1.6
27	2.40	2.15	5.50	.....	2.30	1.05	.70	1.60	.7	.70	1.0	1.55
28	2.40	2.15	4.70	3.10	3.35	1.00	.75	1.55	.65	.70	1.2	1.45
29	2.45	.....	2.90	2.90	3.20	.95	.70	1.35	.65	.70	1.3	1.40
30	2.40	.....	3.45	2.70	3.15	.90	.70	1.15	.60	.70	1.25	3.57
31	2.35	.....	2.30	.....	3.05	.....	.70	1.00	.....	.90	.....	2.95

a No record kept.

Current meter measurements were made as follows:

DATE.	Gauge height	Discharge, second-feet.	Hydrographer.
July 5, 1900	0.85	87	E. D. Walker.
August 22, 1900	0.47	141	E. D. Walker.

The station was abandoned early in 1901, but was resumed temporarily in order to maintain a continuous record until repairs are completed at the Schoharie Falls station one mile upstream.

SCHOHARIE CREEK AT SCHOHARIE FALLS, MONTGOMERY COUNTY, N. Y.

A dam and power plant were erected by the Empire State Power Company of Amsterdam, N. Y., at Schoharie Falls, 7 miles from the city of Amsterdam in 1900.[a] A record of the stream was kept, beginning July 18, 1900. April 22d, 1901, the record was temporarily discontinued during repairs of injuries resulting from high water of that date.

Soon after the completion of the dam, a weir of standard form was placed in an opening in the water power canal embankment, at a point where the entire flow of the stream could be concentrated so as to pass over the gauging weir. The weir had a sharp crest 25 feet in length, with two complete contractions, and the observations of flow given below were computed from the observed depth by means of the Francis formula.

[a] Described in Engineering Record, Aug. 10, 1901, pp. 122-128.

Fig. No. 79.—Schoharie Falls Dam, Montgomery County, N. Y., showing form of crest section.

Mean Daily Flow in Second-feet of Schoharie Creek at Schoharie Falls, N. Y.

[Drainage area, 930 square miles.]

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1900.												
1	......	......	......	......	......	......	......	87.75	43.9	25.7	74.7	1,060.3
2	......	......	......	......	......	......	......	66.8	43.9	26.9	73.0	937.2
3	......	......	......	......	......	......	......	57.9	41.95	25.8	68.1	983.5
4	......	......	......	......	......	......	......	44.3	41.4	25.4	68.6	2,011.5
5	......	......	......	......	......	......	......	35.2	50.4	25.1	68.7	1,901.6
6	......	......	......	......	......	......	......	32.5	47.4	25.9	69.7	1,825.0
7	......	......	......	......	......	......	......	36.2	42.7	26.0	71.15	1,788.7
8	......	......	......	......	......	......	......	31.9	41.6	25.1	78.5	1,699.5
9	......	......	......	......	......	......	......	24.9	35.9	25.7	82.0	1,511.3
10	......	......	......	......	......	......	......	21.4	33.9	30.1	86.0	1,151.2
11	......	......	......	......	......	......	......	21.4	32.95	31.2	86.1	989.6
12	......	......	......	......	......	......	......	20.2	33.9	31.5	121.7	980.3
13	......	......	......	......	......	......	......	21.9	33.8	32.15	214.5	918.2
14	......	......	......	......	......	......	......	20.8	31.0	33.1	215.5	901.7
15	......	......	......	......	......	......	......	20.65	30.1	32.4	213.6	801.5
16	......	......	......	......	......	......	......	29.0	29.7	39.1	216.3	815.8
17	......	......	......	......	......	......	......	592.9	28.0	41.7	224.1	809.2
18	......	......	......	......	......	......	105.6	344.2	27.8	36.95	285.7	811.7
19	......	......	......	......	......	......	96.65	294.9	27.3	35.2	278.0	813.1
20	......	......	......	......	......	......	87.7	153.0	26.2	35.7	319.7	859.6
21	......	......	......	......	......	......	209.4	101.3	25.0	37.2	615.1	954.6
22	......	......	......	......	......	......	123.3	96.7	23.9	36.8	607.1	1,074.1
23	......	......	......	......	......	......	118.2	96.5	23.7	52.0	581.5	1,150.1
24	......	......	......	......	......	......	114.6	87.6	23.8	58.6	598.0	1,588.5
25	......	......	......	......	......	......	127.5	72.8	24.9	53.5	609.1	4,205.5
26	......	......	......	......	......	......	114.85	66.1	21.4	52.4	952.1	3,701.5
27	......	......	......	......	......	......	115.2	60.7	20.8	72.1	1,858.1	3,252.5
28	......	......	......	......	......	......	105.6	57.6	24.9	69.7	1,652.0	2,852.6
29	......	......	......	......	......	......	98.7	53.3	24.9	70.7	1,465.5	2,251.7
30	......	......	......	......	......	......	87.7	57.6	31.0	67.9	1,021.5	983.5
31	......	......	......	......	......	......	87.9	50.4	......	72.7	......	985.7
Mean	......	......	......	......	......	......	110	89	32	40	427	1.526
1901.												
1	1,244	199	159	656	......	......	......	......	......	......	......	......
2	1,369	193	169	1,170	......	......	......	......	......	......	......	......
3	1,165	139	169	1,568	......	......	......	......	......	......	......	......
4	1,417	160	160	2,743	......	......	......	......	......	......	......	......
5	1,272	169	320	5,604	......	......	......	......	......	......	......	......
6	1,298	169	581	8,634	......	......	......	......	......	......	......	......
7	1,181	169	649	15,643	......	......	......	......	......	......	......	......
8	1,058	157	3,180	6,029	......	......	......	......	......	......	......	......
9	1,002	149	451	4,952	......	......	......	......	......	......	......	......
10	987	141	3,376	4,412	......	......	......	......	......	......	......	......
11	1,044	127	1,239	3,717	......	......	......	......	......	......	......	......
12	1,126	143	3,079	2,617	......	......	......	......	......	......	......	......
13	1,377	161	5,220	2,470	......	......	......	......	......	......	......	......
14	1,284	195	2,226	2,832	......	......	......	......	......	......	......	......
15	1,006	165	1,375	3,012	......	......	......	......	......	......	......	......
16	916	199	955	2,854	......	......	......	......	......	......	......	......
17	931	268	789	2,866	......	......	......	......	......	......	......	......
18	917	183	675	2,554	......	......	......	......	......	......	......	......
19	641	143	880	1,366	......	......	......	......	......	......	......	......
20	557	141	610	2,856	......	......	......	......	......	......	......	......
21	471	149	24,608	10,356	......	......	......	......	......	......	......	......
22	423	159	8,249	24,553	......	......	......	......	......	......	......	......
23	466	169	6,354	......	......	......	......	......	......	......	......	......
24	553	149	4,255	......	......	......	......	......	......	......	......	......
25	651	149	4,185	......	......	......	......	......	......	......	......	......
26	680	169	4,811	......	......	......	......	......	......	......	......	......
27	696	169	10,853	......	......	......	......	......	......	......	......	......
28	556	169	3,605	......	......	......	......	......	......	......	......	......
29	647	......	5,330	......	......	......	......	......	......	......	......	......
30	562	......	1,148	......	......	......	......	......	......	......	......	......
31	888	......	648	......	......	......	......	......	......	......	......	......
Mean	896	166	3,400	5,043	......	......	......	......	......	......	......	......

Weir Measurements of Schoharie Creek at Schoharie Falls.

DATE.	Time.	Second-feet.
June 25	11 a. m.	86.2
June 26	11 a. m.	91.6
June 26	5 p. m.	91.5
June 27	11 a. m.	92.9
June 27	5 p. m.	92.9
June 28	11 a. m.	86.2
June 28	5 p. m.	91.5
June 29	11 a. m.	86.2
June 29	5 p. m.	86.2
June 30	11 a. m.	92.9
June 30	5 p. m.	92.9
July 1	11 a. m.	92.9
July 1	5 p. m.	91.5
July 2	11 a. m.	91.6
July 2	5 p. m.	92.9
July 3	9 a. m.	93.4

From July 18 to December 31, 1900, the power plant was not in operation, and the entire flow of the stream passed over the main spillway of the dam. The discharge was computed by F. J. Lempe, C. E., by means of the Francis formula.

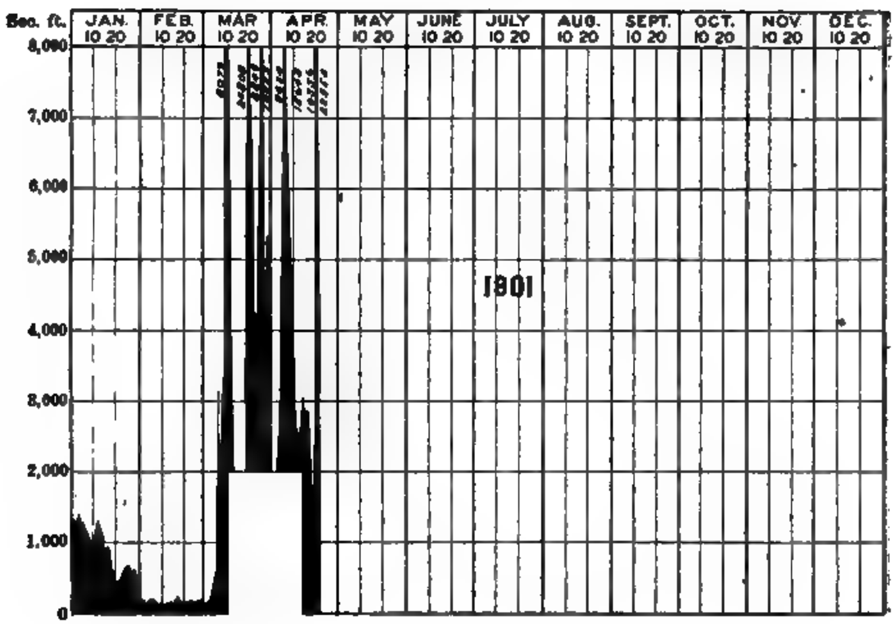
The dam is of masonry, backed with timber. It has a flat crest, 1 foot in width and a slope on the upstream face of approximately 2½ to 1. The crest is 380 feet long. The elevation of the profile varies from 205.14 to 205.47 above datum. A discharge curve has been calculated by dividing the crest into six arbitrary sections, each assumed to be level. The coefficients of discharge used are those for a dam of similar cross sections calibrated in Cornell University experiment No. 5.[a]

Adjacent to the dam is an overflow having a crest 50 feet in length. Water is conducted to the power plant through an open earth canal 3,900 feet long. The power canal terminates in a gate house from which the water is fed to the turbines through two 150-foot steel penstocks, 8 feet internal diameter.

The power plant contains two pairs of 40-inch bronze bucket Leffel-Samson turbines in horizontal cases. The speed is regulated by means of Lombard governors and the record includes the mean gate openings as shown by these governors, and the working head on water wheels. A test was made of the discharge of pair No. 2 of turbines, April 5, 1901.

Working head on wheels, 35.61 feet.

[a] Transactions Am. Soc. C. E., Vol. XLIV, p. 274.



No. 80.—Discharge of Schoharie Creek at Schoharie Falls, Schoharie County, N. Y., 1901.

Average gate opening during test, 44.9 per cent of full opening.

Discharge measurement by current meter in power canal, 216 second-feet.

Calculated discharge from manufacturer's rating table, 210 second-feet.

The waste by leakage of canal banks, wheel gates and penstocks has been estimated by Mr. Lempe as not more than 5 second-feet.

Excessive flood discharges at this station result from the breaking up of ice gorges formed farther upstream. During such a freshet on March 21, 1901, the water attained a depth of 11.2 feet on the crest of the dam, the calculated discharge being 49,600 second-feet or 53.3 second-feet per square mile from 930 square miles of tributary drainage area. April 22, 1901, heavy rains produced a freshet giving a discharge of 38,400 second-feet or 41.3 second-feet per square mile.

Drainage Areas of Schoharie Creek.

LOCATION.	Drainage area, square miles.
Mouth	947
Erie Canal aqueduct	946.8
Fort Hunter dam	946.7
Mill Point Bridge	934
Schoharie Falls dam	930

Mean Monthly Run-off of Schoharie Creek at Schoharie Falls.

[Drainage area 930 square miles.]

	SECOND-FEET.		SECOND-FEET PER SQUARE MILE.		INCHES ON DRAINAGE AREA.	
	1900.	1901.	1900.	1901.	1900.	1901.
January	....	896	....	0.97	....	1.12
February	....	166	....	0.18	....	0.19
March	....	3,400	....	3.61	....	4.15
April	....	5,043	....	5.44	....	6.09
May	....	....	....	....	....	....
June	....	....	....	....	....	....
July	110	....	0.12	....	0.14	....
August	89	....	0.10	....	0.11	....
September	32	....	0.03	....	0.03	....
October	40	....	0.04	....	0.01	....
November	427	....	0.46	....	0.51	....
December	1,526	....	1.65	....	1.89	....

MOHAWK RIVER AT SCHENECTADY, SCHENECTADY COUNTY, N. Y.

A current meter station at Freeman's toll bridge, one mile below Schenectady, was established by Elton D. Walker, February 1, 1899.[a] A wire and weight gauge is used; the scale is attached horizontally to the guard-rail on the upstream side of the bridge and reads decimally from zero to 16 feet. A reading of the water stage is taken each morning by L. Diggins.

The bridge stands squarely across the stream. Its length between abutments is 417 feet. The piers and crib foundations obstruct the channel, which has a depth in high water of 20 feet or more. The station is 2½ miles above the Rexford Flats dam, and the water levels are essentially the same at the two stations. The current is exceptionally smooth and uniform. The entire flow of the river passes under the bridge, except in time of very unusual freshets. The current is sluggish during low water, owing to backwater from Rexford Flats dam, and discharge measurements for minimum stages are considered less reliable than those for higher gauge readings.

Current Meter Discharge Measurements, Mohawk River at Freeman's Bridge.

DATE.	Gauge height, feet.	Discharge, second-feet.	Hydrographer.
July 17, 1900	5.26	667	Elton D. Walker.
June 30, 1899	5.38b	482	Elton D. Walker.
August 21, 1900	5.40	976	Elton D. Walker.
May 26, 1899	6.22b	2,091	Elton D. Walker.
May 12, 1900	6.50	4,125	Elton D. Walker.
June 13, 1901	6.55	4,448	J. D. Luther.
May 27, 1901	6.73	5,406	J. D. Luther.
May 16, 1901	7.12	6,263	R. E. Horton.
April 3, 1899	7.18b	5,294	Elton D. Walker.
May 14, 1901	8.28	10,719	R. E. Horton.
April 4, 1901	9.92	18,473	R. E. Horton.

a See Water Supply and Irrigation Paper, U. S. Geol. Survey, No. 35, p. 55.

b Meter No 71, used in these measurements, needed rerating. Results subject to revision.

Mean Daily Flow in Second-feet of Mohawk River at Schenectady N. Y.

[Drainage area, 3,321 square miles.]

a Exceeds limit of rating curve.

Mean Daily Flow in Second-feet of Mohawk River at Schenectady.—(Concluded.)

[Drainage Area 3,321 square miles.]

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1	3,640	2,540	1,550	10,500	8,790	9,370	1,490	3,010	1,130	1,250	900	2,400
2	3,600	2,120	1,490	8,560	7,440	10,700	1,250	2,410	1,550	1,060	850	1,550
3	2,700	1,660	1,260	8,750	7,290	11,390	1,260	[illegible]	3,400	1,900	730	3,01[illegible]
4	2,120	1,550	1,400	18,200	6,720	10,820	1,130		3,400	1,000	800	4,440
5	3,010	1,550	1,600	a	5,310	9,130	1,130		3,330	1,840	730	6,540
6	2,120	1,240	1,840	a	4,270	7,080	1,240		2,800	1,550	730	2,560
7	1,940	1,400	1,980	a	3,480	11,500	4,110		2,120	1,480	680	1,940
8	2,410	1,260	1,840	a	3,010	a	3,840		1,080	1,390	620	1,692
9	2,120	1,550	1,660	a	2,700	13,220	3,010		1,280	1,280	620	1,602
10	2,540	1,660	1,980	a	2,410	10,100	2,270		1,120	1,280	560	2,12[illegible]
11	3,640	1,400	3,640	17,880	3,330	7,990	1,840		1,260	1,130	730	a
12	3,960	1,836	6,180	14,870	8,520	5,830	1,840		1,550	1,080	1,020	17,080
13	4,600	1,660	7,600	14,160	11,930	4,620	1,780		1,550	1,080	1,400	13,000
14	3,760	1,550	6,000	13,930	11,500	3,600	1,550		2,120	2,120	6,900	9,780
15	3,330	1,660	5,650	14,160	8,530	3,480	1,200		2,410	5,480	5,490	a
16	3,040	1,400	6,540	14,400	6,330	2,700	1,130		2,540	6,900	3,900	a
17	3,010	1,840	6,540	13,490	4,950	2,270	1,130		2,080	4,620	4,750	a
18	3,640	1,660	6,100	13,120	4,750	1,960	1,260	2,120	3,800	3,480	2,700	15,[illegible]
19	3,450	1,400	7,250	13,400	7,630	1,640	1,610	1,660	3,170	3,010	2,540	10,900
20	2,700	1,550	9,510	12,590	8,180	1,780	1,080	1,300	2,080	3,170	2,410	8,500
21	2,960	1,660	11,220	14,160	9,330	1,550	1,060	1,000	2,340	2,640	2,010	5,601
22	2,540	1,840	a	a	6,770	3,640	1,490	2,410	1,060	2,270	2,010	3,790
23	2,410	1,550	a	a	5,650	8,540	1,130	3,800	1,400	2,180	2,120	4,740
24	3,330	1,400	10,300	a	6,900	9,900	860	2,120	1,130	1,980	1,840	3,642
25	3,010	1,260	13,700	a	6,720	9,790	1,000	2,410	1,120	1,080	1,080	4,270
26	2,700	1,400	a	a	6,000	6,380	860	3,010	1,060	1,400	2,660	4,440
27	2,560	1,130	a	18,300	4,960	3,330	730	2,410	860	1,200	3,010	3,642
28	5,070	1,400	a	13,250	5,480	2,410	600	1,840	780	1,200	2,980	2,790
29	3,960	......	a	10,300	10,820	1,990	1,080	1,550	880	1,000	1,400	3,642
30	1,860	......	16,300	8,750	10,100	1,660	1,130	1,280	1,130	1,000	1,550	4,440
31	2,410	......	12,140	......	10,960	......	1,260	1,200	......	1,000	......	8,500
Mean	3,079	1,577	6,141	12,811	6,761	6,133	1,532	1,951	1,857	2,000	2,098	4,967

a Exceeds limit of rating curve.

Mean Monthly Run-Off of Mohawk River at Schenectady.

[Drainage area 3,321 square miles.]

SECOND-FEET.

MONTH.	1899.	1900.	1901.
January	....	....	3,079
February	4,782	....	1,577
March	a	....	a
April	a	a	a
May	5,715	3,582	6,761
June	1,140	1,336	6,133
July	1,070	1,065	1,533
August	534	[illegible]	1,951
September	1,133	[illegible]	1,857
October	1,210	[illegible]	2,000
November	....	a	2,098
December	....	5,614	4,967

a Record incomplete. Discharge over 18,900 second-feet omitted.

Fig. No. 81.—Discharge of Mohawk River at Schenectady, Schenectady County, N. Y., 1899.

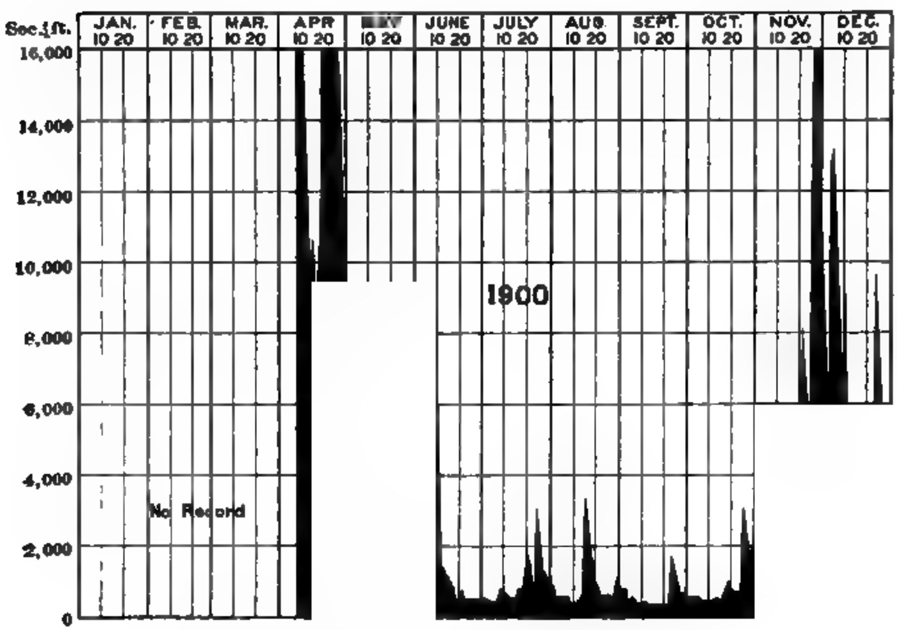


Fig. No. 82.—Discharge of Mohawk River at Schenectady, Schenectady County, N. Y., 1900.

Fig No. 83 - Discharge of Mohawk River at Schenectady, Schenectady County, N. Y., 1901.

SECOND-FEET PER SQUARE MILE.

MONTH.	1899.	1900.	1901.
January	....	....	.93
February	1.44	....	.48
March	a	....	a
April	a	a	a
May	1.72	1.07	2.03
June	.34	.40	1.85
July	.32	.30	.46
August	.16	.26	.59
September	.34	.18	.59
October	.36	.27	.61
November	....	1.09	.61
December	....	1.69	1.48

IN INCHES ON DRAINAGE AREA.

MONTH.	1899.	1900.	1901.
January	....	....	1.06
February	1.50	....	.50
March	a	....	a
April	a	a	a
May	1.98	1.23	2.28
June	.36	.45	2.07
July	.37	.35	.53
August	.18	.30	.68
September	.38	.20	.66
October	.41	.31	.72
November	....	1.22	.68
December	....	1.94	1.71

A discharge-curve deduced from the meter observations has been used to reduce the gauge readings to equivalent volumes of flow. Tables showing the daily gauge height are given in connection with the slope gaugings of Mohawk River on page 504. Referring to pages 495 and 501, it will be seen that the three gauging stations on the Lower Mohawk, at Freeman's Bridge, Rexford Flats, and Dunsbach Ferry, show close agreement in the monthly run-off. Differences which appear in the mean daily discharge on simultaneous dates may be attributed to pond-storage; to diversion to Erie Canal at Rexford Flats, and to the fact that some time is required for water to travel from station to station. Of the three records, that kept at Dunsbach Ferry is probably most reliable. The percentage of error for either of the three is probably smaller for medium stages of the stream than for extreme high or extreme low water.

a Record incomplete. Discharges over 18,900 second-feet omitted.

Drainage Areas Tributary to Lower Mohawk River Gauging Stations.

LOCATION.	Square miles.	Difference square miles.
Schenectady	3,321	64
Rexford Flats	3,385	55
Dunsbach Ferry	3,440	23
Mouth of stream	3,463	....

MOHAWK RIVER AT REXFORD FLATS, SARATOGA COUNTY, N. Y.

This gauging station is located at the New York State feeder dam, four miles below Schenectady. The dam is of masonry with a timber apron. Experiments on a similar cross section were made at Cornell University to determine the proper coefficients of discharge.[a]

The accompanying tables of daily and monthly mean flow include the amount of water diverted for Erie Canal supply. They therefore represent the total inflow of Mohawk River to the pond above the dam, which is considerably greater than the amount which passes downstream from the dam during the season of canal navigation. The amount of diversion to the Erie Canal, prior to 1900, was assumed to be constantly equal to 128 second-feet during navigation months. Beginning with 1900, the diversion has been estimated by another method. Current meter measurements of the flow in Rexford Flats feeder gave the following results:

DATE.	Hydrographer.	Flow in canal feeder, second-feet.
October 27, 1898	W. D. Lockwood	128
June 25, 1901	R. E. Horton	272
April 4, 1901	R. E. Horton	19[b]
May 15, 1901	R. E. Horton	226

A comparison of these results, with the mean monthly evaporation rate from a water surface for several years, as shown by records kept at Rochester, indicates that there is a nearly con-

a See Transactions, Am. Soc. C. E., Vol. XLIV, p. 284.

b Leakage of feeder gates.

stant ratio between the water required for the canal and the mean monthly evaporation. The monthly diversion has been estimated from the above data by proportion, for each month of the canal season as follows:

MONTH.	Mean evaporation, inches.	Estimated diversion to canal, second-feet
May	4.05	20[illegible]
June	4.98	260
July	5.64	290
August	5.28	270
September	4.07	2[illegible]0
October	3.18	148
November	1.51	95

The flow over the dam taken alone, that is, the amount of water passing downstream from Rexford Flats during the canal months, has been estimated as follows, in second-feet:

MONTH.	1899.	1900.	1901.
May	3,956	2,657	6,146
June	1,886	1,243	6,408
July	370	1,157	1,540
August	166	1,476	1,050
September	752	761	1,775
October	1,480	536	811
November	2,696	3,335	1,995

The profile of the dam is quite irregular and is divided into five sections, each assumed to be level for purposes of computation. The water has not fallen below the crest since the establishment of the station and the profile of the dam obtained before the record was started, has been used throughout. The leakage of the dam has not been estimated.

When ice from Schoharie Creek and other tributaries flows out, and occasionally during other freshets caused by rainfall, the water on the downstream side rises above the level of the crest of the dam. Experiments on the flow over a similar submerged wier are not available. The high water flows have been taken from the discharge curve. The crest gauges are situated about 50 feet upstream from the dam. At flood stages of the

stream, the water flows through the cross section opposite the gauges with a relatively high velocity of approach. Owing to this fact and to the drowning of the dam by backwater, the calculated flood discharges given below are considered as approximate only.

DATE.	Estimated discharge, second-feet.	Discharge, second-feet, per square mile.
February 14, 1900	55,700	16.5
April 22, 1901	49,400	14.6
December 15, 1901	51,250	16.0

Mean Daily Flow in Second-feet of Mohawk River at Rexford Flats, Saratoga County, N. Y.

[Drainage area, 3,385 square miles.]

DAY.	Jan.	Feb.	Mar.	Apr.								
1898.												
1	......	......	......	......								
2	......	......	......	......								
3	......	......	......	......								
4	......	......	......	......								
5	......	......	......	......								
6	......	......	......	......								
7	......	......	......	......								
8	......	......	......	......								
9	......	......	......	......								
10	......	......	......	......								
11	......	......	......	......								
12	......	......	......	......								
13	......	......	......	......								
14	......	......	......	......								
15	......	......	......	......								
16	......	......	......	......								
17	......	......	......	......								
18	......	......	......	......								
19	......	......	......	......								
20	......	......	......	......								
21	......	......	......	......								
22	......	......	......	......								
23	......	......	......	......								
24	......	......	......	......								
25	......	......	......	......								
26	......	......	......	......								
27	......	......	......	......								
28	......	......	......	......								
29	......	......	......	......								
30	......	......	......	......								
31	......	......	......	......								
Mean.	......	......	......	......	......	......	......	......	......	......	......	4,471
1899.												
1	9,000	2,950	6,300	5,850	2,828	2,288	928	328	228	2,728	1,368	1,328
2	4,830	2,400	5,750	6,250	6,828	2,288	928	328	228	1,928	1,368	1,328
3	3,350	4,350	5,170	5,350	3,428	2,078	678	428	228	2,928	2,928	3,208
4	3,600	3,950	4,460	5,270	8,528	[illegible]	608	458	228	2,628	5,028	2,448
5	9,350	3,050	6,920	7,880	5,828	2,078	608	528	228	2,028	6,528	2,628
6	16,850	4,550	25,700	10,510	5,178	1,538	608	608	228	3,078	6,528	2,908
7	12,550	3,350	15,110	14,050	2,628	1,638	438	378	228	2,478	8,628	3,578
8	9,350	2,700	9,770	18,830	2,828	1,638	438	278	228	3,328	9,028	[illegible]
9	7,925	2,600	8,450	21,770	2,324	1,378	608	278	728	3,178	7,928	6,078
10	4,850	2,400	8,850	13,840	2,178	1,378	528	278	218	1,428	4,828	8,628
11	[illegible]	2,100	7,000	15,590	2 178	1,128	438	278	228	728	2,778	8,858
12	3,600	2,850	9,160	18,600	2,478	1,128	438	278	238	728	2,178	10,028
13	2,830	3,350	20,070	24,040	2,328	928	378	278	228	728	1,578	10,828
14	3,825	4,750	14,000	29,550	2,078	928	328	278	328	728	1,928	15,828
15	4,650	4,650	10,930	30,680	1,828	1,038	328	278	228	1,378	2,078	21,358
16	5,400	3,650	10,050	29,360	2,428	1,038	328	278	278	1,578	1,578	24,228
17	8,750	3,400	8,350	22,000	1,978	2,928	758	278	278	1,828	1,368	19,128
18	9,200	2,700	5,750	20,650	1,778	3,524	928	278	278	[illegible]	1,368	13,128
19	5,400	2,400	5,470	20,350	[illegible]	4,628	678	228	278	1,428	1,128	8,128
20	4,475	2,400	8,250	21,150	4,778	5,128	678	228	278	1,318	1,128	10,228
21	2,850	2,250	13,560	31,628	6,028	2,628	488	[illegible]	278	1,348	1,228	6,328
22	2,850	2,600	12,600	19,228	6,828	3,228	328	228	278	1,348	1,478	4,978
23	2,750	5,450	11,400	17,878	6,728	2,168	328	228	278	1,228	1,578	4,578
24	3,050	10,150	8,460	17,878	5,428	2,168	308	228	278	1,148	1,578	[illegible]
25	3,450	5,750	7,050	17,878	4,928	2,078	288	228	278	1,128	1,408	2,428
26	4,300	5,550	6,740	17,028	4,378	1,538	288	278	3,228	1,028	1,868	2,928
27	4,475	4,650	5,370	16,428	3,128	1,538	328	278	9,178	828	1,128	3,028
28	4,950	7,000	4,750	16,428	2,228	1,538	438	228	6,328	728	1,128	2,828
29	4,750	......	4,650	15,668	1,828	1,478	328	208	1,678	1,328	1,128	2,628
30	5,675	......	5,560	11,148	2,778	1,538	378	208	2,778	1,348	[illegible]	3,428
31	4,850	......	5,170	......	2,778	......	338	208	......	1,318	......	2,228
Mean.	5,738	3,995	9,004	17,067	4,084	2,014	498	291	960	1,608	2,824	7,001

Mean Daily Flow in Second-feet of Mohawk River at Rexford Flats, Saratoga County, N. Y.

(Drainage area, 3,385 square miles.)

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1900.												
1	2,000	2,250	4,000	6,700	5,300	1,470	1,500	1,970	1,900	[illegible]	1,[illegible]	[illegible]
2	1,500	1,640	4,000	9,400	6,000	1,472	940	1,800	1,620	[illegible]	1,[illegible]	[illegible]
3	1,500	2,400	4,450	11,150	4,150	1,540	900	1,730	1,670	[illegible]	1,[illegible]	[illegible]
4	1,300	2,820	4,450	11,400	3,300	1,710	900	1,720	1,540	364	1,[illegible]	[illegible]
5	1,300	4,450	4,450	12,810	2,850	1,7[illegible]0	[illegible]	1,720	1,420	[illegible]	1,[illegible]	7,711
6	1,500	4,850	4,300	13,550	3,0[illegible]	1,470	750	1,970	1,420	346	1,[illegible]	11,[illegible]
7	1,500	5,300	2,225	13,850	3,450	1,470	750	1,720	1,420	[illegible]	1,[illegible]	[illegible]
8	2,250	7,150	3,000	14,451	3,300	1,7[illegible]0	850	1,970	1,[illegible]	340	1,[illegible]	[illegible]
9	2,500	7,250	2,250	15,075	3,000	1,710	1,000	1,970	1,[illegible]	348	2,300	7,[illegible]
10	2,850	7,050	2,250	15,950	4,607	1,000	1,000	1,970	1,120	340	3,577	......
11	1,[illegible]	10,720	1,[illegible]	17,150	3,000	2,200	1,720	1,97[illegible]	1,220	348	3,[illegible]	......
12	1,610	13,050	1,610	18,300	3,000	2,030	1,500	1,970	1,[illegible]	425	3,[illegible]	......
13	1,507	27,250	1,500	15,650	3,300	2,300	1,370	1,970	870	[illegible]	2,750	......
14	1,507	48,050	1,800	12,850	3,300	1,500	1,290	2,750	870	[illegible]	1,[illegible]	......
15	1,020	34,850	1,570	9,300	3,000	1,[illegible]	1,190	2,300	[illegible]	[illegible]	1,700	......
16	2,700	14,850	1,200	9,000	3,300	1,[illegible]	1,[illegible]	2,470	430	[illegible]	1,010	......
17	2,820	9,050	1,100	12,300	3,000	1,710	1,[illegible]	5,[illegible]	[illegible]	[illegible]	1,610	......
18	4,540	5,750	1,100	20,750	2,850	1,710	1,[illegible]	1,[illegible]	[illegible]	[illegible]	1,300	......
19	10,720	3,150	1,750	27,450	2,700	1,470	1,[illegible]	1,[illegible]	750	[illegible]	1,[illegible]	......
20	21,050	2,470	3,150	23,550	2,250	1,300	1,[illegible]	1,970	870	[illegible]	2,230	......
21	45,750	3,810	3,850	25,250	2,250	1,300	1,[illegible]	1,070	870	[illegible]	6,043	......
22	27,850	5,150	4,000	28,370	1,750	1,300	1,010	1,070	[illegible]	[illegible]	7,430	......
23	20,450	6,[illegible]	4,[illegible]	25,050	1,650	1,000	1,740	1,070	1,030	[illegible]	6,300	......
24	31,750	8,750	5,150	31,750	1,650	1,[illegible]	1,000	1,770	1,030	[illegible]	6,577	3,[illegible]
25	12,300	7,850	5,950	17,050	1,650	1,[illegible]	2,570	1,170	750	[illegible]	5,364	4,[illegible]
26	9,250	6,150	6,[illegible]	11,030	1,500	1,[illegible]	2,270	1,070	[illegible]	2,[illegible]	10,[illegible]	4,700
27	8,100	6,150	7,700	11,400	1,000	1,[illegible]	2,[illegible]	9[illegible]0	[illegible]	2,[illegible]	34,150	6,010
28	8,150	4,[illegible]	7,700	9,850	1,050	910	2,[illegible]	1,[illegible]	540	2,300	22,[illegible]	4,[illegible]
29	3,150	......	5,420	8,750	1,425	910	2,270	1,[illegible]	[illegible]	2,100	15,[illegible]	3,[illegible]
30	6,400	......	5,[illegible]	7,250	1,425	910	2,270	1,070	540	2,[illegible]	10,745	3,185
31	4,300	......	5,720	......	1,425	......	1,800	1,170	......	1,[illegible]	......	2,[illegible]
Mean	7,000	9,[illegible]	4,725	16,[illegible]	2,557	1,[illegible]	1,447	1,746	[illegible]	754	5,440	[illegible]
1901.												
1	2,300	1,380	1,870	9,050	7,082	12,301	1,[illegible]	1,057	1,190	[illegible]	[illegible]	1,672
2	2,185	[illegible]	1,360	8,000	6,840	12,301	1,522	1,4[illegible]	1,[illegible]	[illegible]	[illegible]	1,672
3	2,000	[illegible]	1,300	8,322	6,840	10,101	1,522	1,[illegible]	2,074	[illegible]	[illegible]	1,672
4	2,290	870	1,515	15,900	7,082	7,025	1,572	1,344	2,074	[illegible]	[illegible]	1,672
5	2,042	700	1,670	18,320	5,484	6,[illegible]	1,522	......	1,702	[illegible]	[illegible]	1,672
6	1,825	870	1,670	20,920	4,885	6,442	1,522		1,[illegible]	[illegible]	[illegible]	1,[illegible]
7	1,825	[illegible]	1,670	26,275	4,781	9,031	4,[illegible]		1,300	[illegible]	[illegible]	2,104
8	1,515	1,112	1,515	32,000	4,050	15,261	4,[illegible]		1,300	1,[illegible]	[illegible]	2,447
9	1,463	1,205	1,515	24,375	3,000	12,101	2,7[illegible]		1,190	1,[illegible]	[illegible]	2,044
10	2,445	1,205	1,825	18,720	3,102	11,451	2,181		1,190	[illegible]	[illegible]	6,742
11	3,165	1,205	2,000	15,120	2,802	10,041	2,7[illegible]		1,190	[illegible]	[illegible]	8,[illegible]
12	2,380	1,315	6,010	13,600	7,224	9,077	2,161		1,105	[illegible]	[illegible]	8,[illegible]
13	3,263	1,267	6,715	12,000	9,[illegible]	7,025	1,771	......	1,454	[illegible]	1,001	7,701
14	3,705	1,205	6,783	12,700	7,560	6,016	1,070	701	2,310	[illegible]	1,307	10,743
15	2,900	1,315	6,010	12,300	7,724	3,802	1,070	701	2,220	1,043	3,162	40,[illegible]
16	3,135	1,315	5,249	12,300	7,4[illegible]	2,[illegible]	1,070	1,164	2,004	4,247	6,043	44,330
17	3,340	1,670	5,248	11,720	4,985	2,210	1,[illegible]	1,[illegible]	3,082	3,307	3,165	21,[illegible]
18	3,770	2,200	6,249	11,460	6,150	2,117	1,070	2,122	3,264	3,177	4,075	11,400
19	3,185	1,825	6,181	10,920	7,546	1,807	1,920	1,[illegible]	2,074	2,717	3,[illegible]	4,353
20	2,705	1,670	6,090	10,920	7,800	1,807	1,8[illegible]	1,741	2,[illegible]	2,1[illegible]	2,447	3,185
21	2,610	1,825	9,058	12,000	8,810	1,807	1,653	1,344	2,[illegible]	1,354	2,[illegible]	2,507
22	2,872	1,670	24,085	10,380	6,383	3,005	1,310	1,344	6,[illegible]	1,[illegible]	1,672	2,107
23	2,[illegible]	1,615	16,2[illegible]0	33,110	6,383	6,503	1,385	1,364	2,043	[illegible]	1,001	2,073
24	3,185	1,267	15,640	20,650	6,150	9,319	1,085	1,[illegible]	1,878	[illegible]	1,307	3,414
25	2,920	1,305	15,000	32,410	6,218	7,025	1,165	1,001	1,576	[illegible]	1,082	3,107
26	7,415	1,050	27,400	30,040	4,[illegible]	6,447	985	1,057	1,[illegible]	[illegible]	2,447	3,670
27	4,783	1,050	33,670	16,020	5,210	2,797	905	2,277	1,178	[illegible]	3,[illegible]	2,[illegible]
28	3,475	1,205	28,000	14,700	5,917	2,[illegible]	1,[illegible]	1,087	1,[illegible]	[illegible]	2,[illegible]	1,[illegible]
29	2,078	......	21,855	8,840	7,[illegible]	1,[illegible]	1,523	1,300	1,[illegible]	[illegible]	1,[illegible]	1,[illegible]
30	1,670	......	12,600	7,848	8,770	1,652	1,522	1,344	1,[illegible]	[illegible]	1,672	2,674
31	......	......	10,650	......	11,122	......	1,771	1,344	......	[illegible]	......	2,[illegible]
Mean	2,832	1,280	9,221	16,701	6,348	6,[illegible]	1,830	1,320	1,[illegible]	1,050	2,[illegible]	6,[illegible]

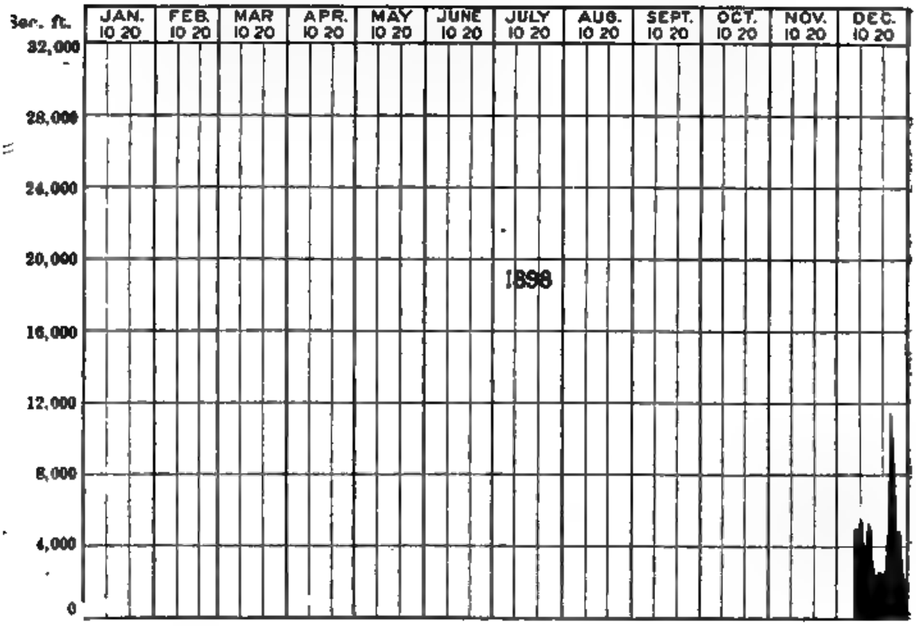


Fig. No. 84.—Discharge of Mohawk River at Rexford Flats, Saratoga County, N. Y., 1898

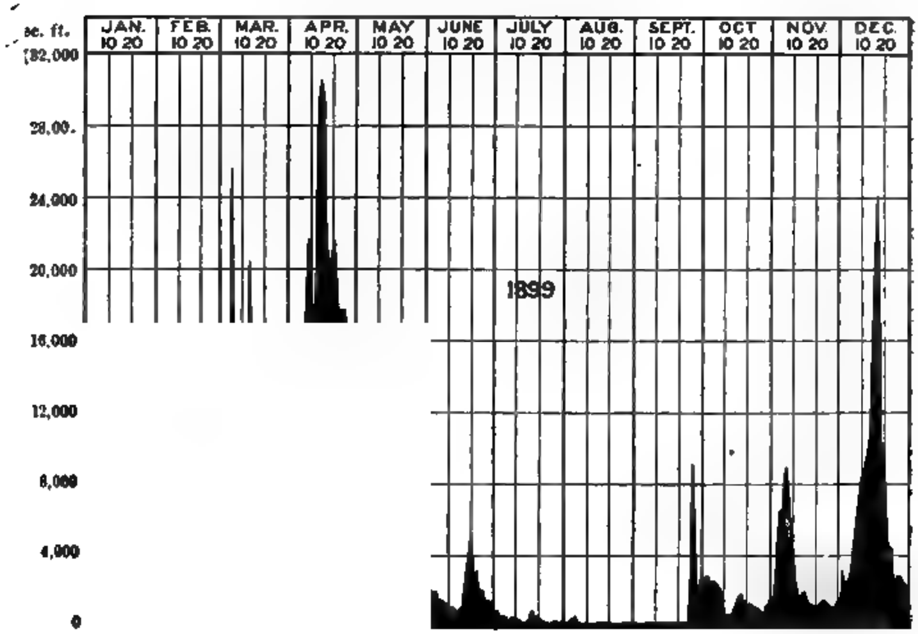


Fig. No. 85.—Discharge of Mohawk River at Rexford Falls, Saratoga County, N. Y., 1899.

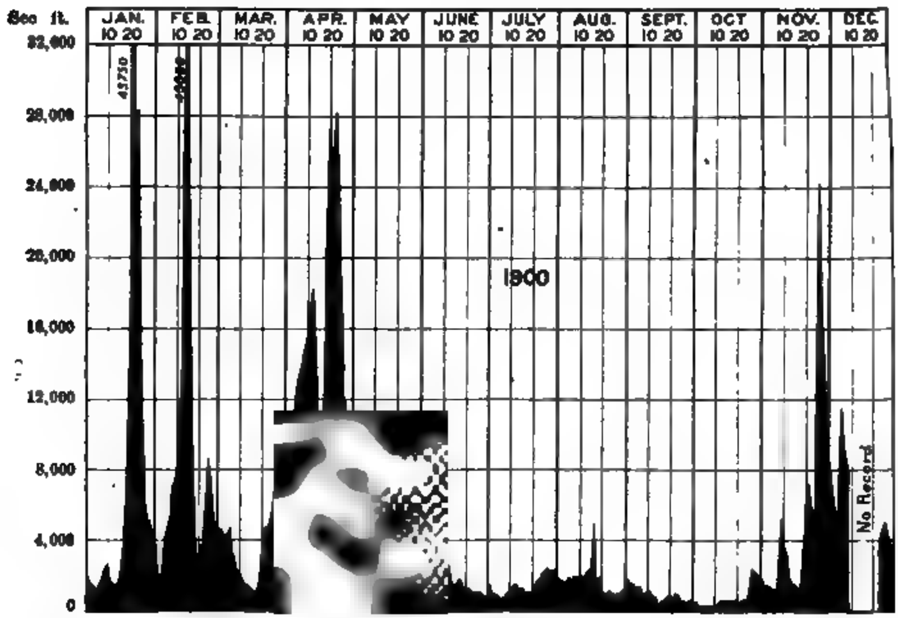


Fig. No. 86.—Discharge of Mohawk River at Rexford Flats, Saratoga County, N. Y., 1900.

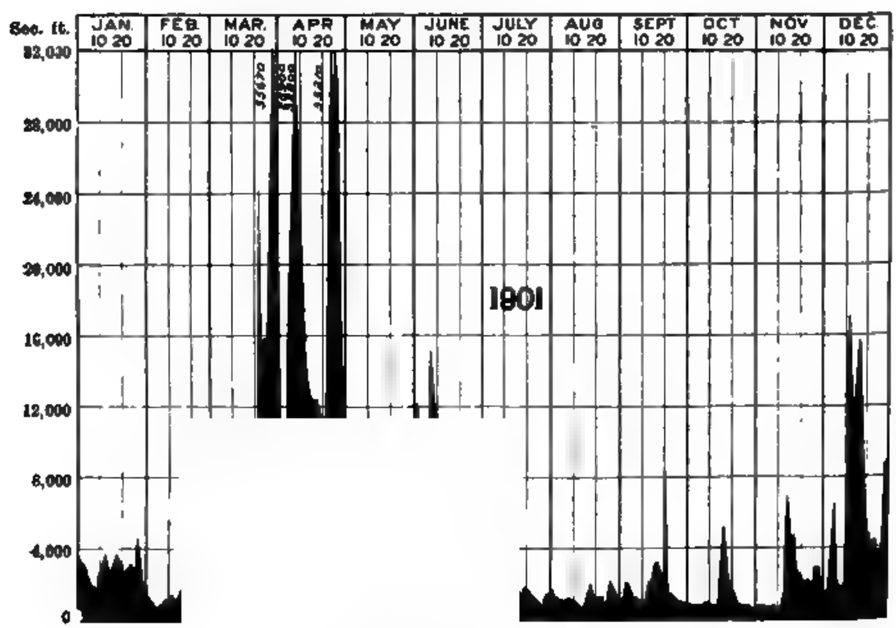


Fig No. 87.—Discharge of Mohawk River at Rexford Flats, Saratoga County, N. Y., 1901.

Mean Monthly Run-Off of Mohawk River at Rexford Flats, Saratoga County, N. Y.

[Drainage area, 3,385 square miles.]

IN SECOND-FEET.

MONTH.	1898.	1899.	1900.	1901.
January	....	5,739	7,860	2,822
February	....	3,935	9,032	1,299
March	....	9,004	4,235	9,221
April	....	17,057	14,996	16,701
May	....	4,084	2,857	6,348
June	....	2,014	1,508	6,668
July	....	498	1,447	1,830
August	....	294	1,746	1,320
September	....	980	981	1,995
October	....	1,608	784	1,057
November	....	2,824	8,440	2,090
December	4,471	7,001	6,066	6,931

IN SECOND-FEET PER SQUARE MILE.

MONTH.	1898.	1899.	1900.	1901.
January	....	1 70	2.32	.83
February	....	1.17	2.67	.38
March	....	2.66	1.25	2.72
April	....	5.04	4.43	4.93
May	....	1.20	84	1 87
June	....	.59	.44	1.97
July	....	.15	.43	.54
August	....	.09	.51	.39
September	....	.29	.29	.59
October	....	.47	.23	.31
November	....	.83	2.49	.62
December	1.32	2.07	1.79	2 04

IN INCHES ON DRAINAGE AREA.

MONTH.	1898.	1899.	1900.	1901.
January	....	1.96	2.67	.95
February	....	1.21	2.77	40
March	....	3.06	1 44	3.14
April	....	5.62	4.94	5.52
May	....	1.38	.96	2.15
June	....	.64	.49	2.21
July	....	.17	.49	.62
August	....	.10	.58	.45
September	....	.32	.32	.66
October	....	.54	.26	.36
November	....	.92	2.79	.69
December	1 52	2.38	2.06	2.35

A record of the area of opening of the gates in the guard lock at the entrance to the feeder, together with the effective head for the period from November 11, to December 9, 1900, showed the mean daily diversion for the last 20 days of November to be 92 second-feet, and for 9 days of December, to the closing of the canal, 105 second-feet.

The dates of opening and closing the canal, between which the record at Rexford Flats is affected by diversion to the feeder, have been as follows:

DATE OPENED.	Date closed.	Days opened.
May 7, 1898	December 10, 1898	217
April 25, 1899	December 1, 1899	220
April 25, 1900	December 1, 1900	220
May 9, 1901	December 15, 1901	220

MOHAWK RIVER NEAR DUNSBACH FERRY, SARATOGA COUNTY, N. Y.

This gauging record is kept at the dam of the West Troy Water Company, one-fifth mile above Dunsbach Ferry Bridge, nine miles from the mouth of the river. The dam is in two sections, situated on opposite sides of a Hudson River shale island. The left wing at the upper end of the island has a crest length of 380 feet. The right wing, 500 feet downstream at the foot of the island, has a crest 280 feet long.

The record was established March 12, 1898, for the primary purpose of checking a system of levels for the United States Board of Engineers on Deep Waterways, by D. J. Howell, C. E., who has furnished the earlier portion of the record. No record was kept from April 1, 1899, to August 1, 1900.

The construction of the dam was begun in 1896. The lower wing was not completed until about October 1st, of the summer of 1898. Openings existed in the dam prior to this date, making the computation of the record, from March to September, 1898, impracticable.

In the pumping station adjoining the dam, are two turbines of the old American type, one 66 inches and the other 75 inches in diameter. A current meter measurement of the flow in the headrace leading to the wheel pit, October 17, 1901, showed the turbines to be using 200 second-feet, under an effective head of 6.7 feet. The rated discharge from the manufacturers tables under the same head is 197 second-feet. These turbines usually run 24 hours each day at full gate capacity. In computing the record, the discharge through the water wheels when running has been taken constantly equal to 200 second-feet. The turbines drive pumps taking water from the river for water supply purposes at the rate of 1,500,000 gallons per day, equivalent to a continuous flow of 2¼ second-feet.

The dam is of masonry, with a flat granite crest 5.5 feet wide, standing 0.75 feet higher at crest lip than at the upstream edge. The average elevation of the crest of the upper section is 174.15 feet. The crest of the lower section has an elevation varying from 173.46 to 173.50 feet. The crest gauge is attached to the timber cribbing 50 feet above the lower section of the dam, with its zero mark at elevation 172.00, referred to the United States Deep Waterways datum. Gauge readings are taken twice daily at intervals of about 12 hours, by Edwin Conners. The mean of the two daily readings is used in computing the flow. The discharge over the main dam has been calculated by means of the weir formula, using coefficients derived from Cornell University experiments No. 18,[a] representing an experimental cross section almost identical with that of the West Troy Company's dam. When the water rises to a height of 5 feet on the gauge, it begins to flow over the masonry headrace wall at the right hand end of the lower section. This has a broad flat surface of rough masonry. The discharge over this portion has been computed from Cornell University experiment No. 12, on a flat crested dam 6.56 feet wide.

During high water the current of the stream through the cross section of the channel leading to the lower dam has a

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[a] See Transactions, Am. Soc. C. E., Vol. XLIV, pp. 277-283.

velocity of several feet per second. The head due to this velocity has been added to the observed head as a correction for velocity of approach to the lower dam. The upper dam is situated 450 feet upstream from the crest gauge. The loss of head from surface slope in this distance as well as the velocity of approach to the upper section of the dam are also corrected for. The elevations of the crest which have been used are those obtained by the United States Deep Waterways Survey. No allowance has been made for leakage of the dam or turbines, which is slight. The drainage area above the Dunsbach Ferry station is 3,440 square miles, or 55 square miles more than at Rexford Flats. Notable high water discharges since the establishment of the record are tabulated below:

DATE.	Gauge height, feet	Second-feet.	Estimated discharge second-feet per sq. mile.
March 14, 1898	8.5	b47,000	13.8
November 11, 1898	8.5	47,400	13.8
November 27, 1900	6.6	24,700	7.2
March 27, 1901	7.9	36,300	10.5
April 8, 1901	7.7	34,200	9.9
April 22, 1901	8.9	46,100	13.4
December 16, 1901	9.5	52,400	15.3

b Approximate.

Mean Daily Flow in Second-feet of Mohawk River at Dunsbach Ferry, Saratoga County, N. Y.

[Drainage area 3,440 square miles].

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1898.												
1	......	......	......	......	......	......	......	......	......	1,429	5,788	4,120
2	......	......	......	......	......	......	......	......	......	1,429	4,920	3,700
3	......	......	......	......	......	......	......	......	......	1,429	4,120	3,320
4	......	......	......	......	......	......	......	......	......	1,429	4,120	3,320
5	......	......	......	......	......	......	......	......	......	1,968	3,320	3,700
6	......	......	......	......	......	......	......	......	......	18,636	3,320	4,920
7	......	......	......	......	......	......	......	......	......	8,712	3,320	4,520
8	......	......	......	......	......	......	......	......	......	4,520	3,320	4,120
9	......	......	......	......	......	......	......	......	......	4,120	3,700	4,120
10	......	......	......	......	......	......	......	......	......	3,700	4,520	4,120
11	......	......	......	......	......	......	......	......	......	2,644	41,200	3,700
12	......	......	......	......	......	......	......	......	......	2,306	26,420	3,320
13	......	......	......	......	......	......	......	......	......	2,306	16,440	2,982
14	......	......	......	......	......	......	......	......	......	2,644	12,602	2,644
15	......	......	......	......	......	......	......	......	......	5,788	9,764	2,644
16	......	......	......	......	......	......	......	......	......	12,602	7,660	2,644
17	......	......	......	......	......	......	......	......	......	9,238	5,788	2,644
18	......	......	......	......	......	......	......	......	......	6,724	5,788	2,644
19	......	......	......	......	......	......	......	......	......	4,920	5,788	2,644
20	......	......	......	......	......	......	......	......	......	4,520	12,024	2,644
21	......	......	......	......	......	......	......	......	......	4,520	9,238	2,644
22	......	......	......	......	......	......	......	......	......	4,920	6,724	3,320
23	......	......	......	......	......	......	......	......	......	7,660	6,256	5,788
24	......	......	......	......	......	......	......	......	......	8,712	6,724	10,868
25	......	......	......	......	......	......	......	......	......	7,660	6,724	10,290
26	......	......	......	......	......	......	......	......	......	6,724	5,320	8,712
27	......	......	......	......	......	......	......	......	......	9,764	5,320	6,724
28	......	......	......	......	......	......	......	......	......	15,788	3,320	4,920
29	......	......	......	......	......	......	......	......	......	13,180	3,320	3,320
30	......	......	......	......	......	......	......	......	......	9,238	3,320	2,644
31	......	......	......	......	......	......	......	......	......	6,724	......	4,120
Mean.	......	......	......	......	......	......	......	......	......	6,821	8,007	4,252
1899												
1	7,192	1,968	7,660	......	......	......	......	......	......	......	......	......
2	4,920	1,968	6,724	......	......	......	......	......	......	......	......	......
3	4,120	1,968	5,788	......	......	......	......	......	......	......	......	......
4	4,520	1,968	4,520	......	......	......	......	......	......	......	......	......
5	4,920	1,968	4,920	......	......	......	......	......	......	......	......	......
6	18,636	1,968	24,740	......	......	......	......	......	......	......	......	......
7	13,180	1,630	20,100	......	......	......	......	......	......	......	......	......
8	9,764	1,429	12,024	......	......	......	......	......	......	......	......	......
9	7,660	1,027	8,712	......	......	......	......	......	......	......	......	......
10	5,788	1,027	8,186	......	......	......	......	......	......	......	......	......
11	4,120	1,027	6,724	......	......	......	......	......	......	......	......	......
12	4,120	1,027	7,192	......	......	......	......	......	......	......	......	......
13	3,320	1,027	20,100	......	......	......	......	......	......	......	......	......
14	3,700	1,027	17,172	......	......	......	......	......	......	......	......	......
15	5,788	1,027	12,602	......	......	......	......	......	......	......	......	......
16	9,764	1,027	10,290	......	......	......	......	......	......	......	......	......
17	8,712	1,027	9,764	......	......	......	......	......	......	......	......	......
18	7,660	1,228	6,724	......	......	......	......	......	......	......	......	......
19	6,724	1,429	5,788	......	......	......	......	......	......	......	......	......
20	4,920	1,429	8,712	......	......	......	......	......	......	......	......	......
21	4,120	1,968	9,764	......	......	......	......	......	......	......	......	......
22	3,320	3,320	7,660	......	......	......	......	......	......	......	......	......
23	3,320	3,320	6,724	......	......	......	......	......	......	......	......	......
24	3,320	4,920	7,660	......	......	......	......	......	......	......	......	......
25	3,700	10,868	9,764	......	......	......	......	......	......	......	......	......
26	4,120	5,788	7,660	......	......	......	......	......	......	......	......	......
27	4,120	5,320	6,724	......	......	......	......	......	......	......	......	......
28	3,320	6,724	5,788	......	......	......	......	......	......	......	......	......
29	2,644	......	5,788	......	......	......	......	......	......	......	......	......
30	2,306	......	5,788	......	......	......	......	......	......	......	......	......
31	2,306	......	5,320	......	......	......	......	......	......	......	......	......
Mean.	5,681	6,086	9,261	......	......	......	......	......	......	......	......	......

Mean Daily Flow in Second-feet of Mohawk River at Dunsbach Ferry, Saratoga County, N. Y.
—(Concluded).

[Drainage area, 3,440 square miles.]

Mean Monthly Run-off of Mohawk River at Dunsbach Ferry, Saratoga County, N. Y.

[Drainage area 3,440 square miles.]

SECOND-FEET.

MONTH.	1898.	1899.	1900.	1901.
January	....	5,681	....	2,567
February	....	6,068	....	1,141
March	....	9,261	....	9,332
April	....	....	....	18,068
May	....	....	....	6,622
June	....	....	....	6,300
July	....	....	....	1,633
August	....	....	930	1,580
September	....	....	672	1,672
October	6,321	....	885	2,066
November	8.007	....	4,922	2.004
December	4,252	....	5,362	8,055

SECOND FEET PER SQUARE MILE.

MONTH.	1898.	1899.	1900.	1901.
January	....	1.65	....	.75
February	....	1.77	....	.33
March	....	2.69	....	2.72
April	....	....	....	5.26
May	....	....	....	1.93
June	....	....	....	1.83
July	....	....	....	.47
August	....	....	.27	.46
September	....	....	.20	.49
October	1.83	....	.26	.60
November	2.33	....	1.43	.58
December	1.24	....	1.56	2.42

IN INCHES ON DRAINAGE AREA.

MONTH.	1898.	1899.	1900.	1901.
January	....	1.90	....	.86
February	....	1.84	....	.34
March	....	3.09	....	3.13
April	....	....	....	5.89
May	....	....	....	2.22
June	....	....	....	2.05
July	....	....	....	.54
August	....	....	.31	.53
September	....	....	.22	.55
October	2.10	....	.30	.69
November	2.60	....	1.60	.65
December	1.43	....	1.79	2.79

MOHAWK RIVER SLOPE GAUGINGS.

A series of gauging stations were established at various points on Mohawk River in 1900 with a view to determining the maximum high water discharge and the downward progress of floods from the cross section and surface slope. These stations

were established under the direction of the State Engineer and Surveyor, in connection with the Barge Canal Survey, by D. J. Howell, M. Am. Soc. C. E., consulting engineer. Gauging stations previously maintained by the United States Geological Survey were utilized as far as possible. On the completion of the investigations of the Barge Canal Survey, the gauge readings at the several stations were continued in connection with the measurement of the volume of streams.

A gauge board was erected at each of the principal points of change of slope, whether occasioned by a dam or by the entrance of a large tributary. The stretch of the river extending between each two successive gauges constitutes a slope section. The gauge boards have been numbered consecutively from 1 to 24, beginning at the mouth of the stream. The elevations of the zero marks of the gauges were determined by a line of precise levels, by Wm. B. Landreth, M. Am. Soc. C. E., Resident Engineer Barge Canal Survey, referred to the Greenbush bench mark = 14.73 as a datum.

Mean Daily Elevation of Water Surface of Mohawk River at Cohoes Co.'s Dam, Gauge No. 1.

DAY.	1900.			1901.			
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	......	154.6	156.0	155.2	154.6	154.1	156.0
2	......	154.7	156.0	155.1	154.6	154.5	155.9
3	......	154.9	155.6	155.0	155.0	154.7	155.9
4	......	155.0	155.6	154.9	154.4	154.3	156.9
5	......	154.6	156.3	154.9	154.3	154.7	157.0
6	......	154.6	156.5	154.9	154.2	154.8	157.2
7	......	154.4	156.1	154.9	154.2	154.9	157.5
8	......	154.3	156.0	154.8	153.7	154.9	156.3
9	......	154.8	156.1	154.9	154.2	154.9	157.6
10	......	155.4	156.1	155.0	155.1	155.0	157.2
11	......	155.8	155.4	155.1	154.0	155.4	156.7
12	......	155.3	155.5	155.3	153.5	155.4	156.5
13	......	155.1	155.5	155.3	153.5	155.4	156.5
14	......	155.0	155.4	155.2	153.5	155.4	156.6
15	......	154.8	155.3	155.1	153.5	155.4	156.5
16	......	154.8	155.2	155.0	153.5	155.5	156.5
17	......	154.9	155.0	155.0	155.0	155.6	156.4
18	......	155.0	155.0	154.9	154.0	155.5	156.4
19	......	154.7	155.0	155.0	153.5	155.5	156.4
20	......	154.8	155.0	155.2	153.5	155.8	156.3
21	......	155.5	155.0	155.0	153.5	156.4	156.8
22	......	155.9	155.3	155.0	153.5	156.9	159.3
23	153.5	155.8	155.3	155.0	154.0	156.9	158.2
24	154.0	155.7	155.4	155.1	154.9	156.8	157.9
25	153.5	155.6	155.8	155.0	154.3	156.8	158.2
26	155.0	156.2	156.0	155.0	154.2	157.4	158.3
27	155.2	157.6	155.7	155.0	154.0	158.2	157.0
28	155.1	157.5	155.6	154.7	154.1	156.1	......
29	154.7	157.0	155.4	154.7	......	157.4	......
30	154.9	156.4	155.4	155.0	......	158.4	......
31	154.8	......	155.3	154.8	......	156.3	......

Mean Daily Elevation of Water Surface of Mohawk River Below West Troy Co.'s Dam, Gauge No. 2.

DAY.	1900.			1901.				
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April.	May.
1	....	165.7	167.7	166.4	165.7	165.4	165.9	166.4
2	....	165.7	167.2	166.4	165 7	165.4	166.9	....
3	....	165.7	167.1	166.1	165.6	165.4	167.8	....
4	....	165.7	167.0	165.9	165.6	165.4	165.2	....
5	....	165.6	168.4	165.9	165.6	165.6	166.5	....
6	....	165.5	168.6	165.8	165.6	165.7	167.0	....
7	....	165.4	168.0	166.0	165.5	165.7	166.6	....
8	....	165.5	167 9	165.7	165.5	165.7	165.4	....
9	....	166.1	167.7	165.7	165.7	165.7	166.8	....
10	....	167.1	167.8	166.0	165.5	165.7	166.9	....
11	....	166.7	167.0	166.4	165.6	166.3	166.2	....
12	....	166.8	166.9	166.5	165.6	166.7	166.1	....
13	....	166.1	167.1	166.4	165.6	166.9	165.1	....
14	....	166.0	166.7	166.8	165.5	166 7	165.2	....
15	....	165.9	166.4	166.3	165.5	166.6	165.2	....
16	....	165.9	166.2	166.2	165.5	166.7	165.2	....
17	....	165.8	166.1	166.2	165.6	166.8	165.1	....
18	....	165.7	166.1	166.8	165.6	166.8	165.2	....
19	....	165.7	166.2	166.5	165.5	167.2	165.2	....
20	....	165.8	166.2	166.4	165.5	167.7	165.2	....
21	165.3	166.9	166.2	166.0	165.6	166.0	165.0	....
22	165.8	167.5	166.2	165.8	165.5	....	....	....
23	165.8	167.8	166.8	166.0	165.5	....	....	....
24	165.3	167.1	166.3	166.8	165.5	....	165.2	....
25	165.3	166.8	166.8	166.1	165.5	....	165.2	....
26	166.2	167.7	167.9	166.0	165.5	....	165.4	....
27	166.1	170.8	167.4	165.9	166.4	....	167.5	....
28	165.9	170.4	167.2	165.8	165.4	....	166.4	....
29	165.8	169.3	166.7	165.8	....	166.5	165.7	....
30	165.8	168.3	166.5	165.8	....	165.1	166.8	....
31	165.8	....	166.3	165.7	....	165.5	....	....

Mean Daily Elevation of Water Surface of Mohawk River Above West Troy Co.'s Dam, Gauge No. 3.

DAY.	1900.			1901.				
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April.	May.
1	....	174.6	176.0	175.2	174.7	174.3	176.7	176.2
2	....	174.6	175.9	175.2	174.6	174.4	176.8	....
3	....	174.6	175.8	175.0	174.8	174.4	176.5	....
4	....	174.6	175.7	174.9	174.7	174.4	177.8	....
5	....	174.5	177 0	174.7	174.6	174.6	178.2	....
6	....	174.4	177.0	174.8	174.5	174.7	178.2	....
7	....	174.4	176 6	174.9	174.5	174.7	178.6	....
8	....	174.4	176.6	174.8	174.4	174.7	179.7	....
9	....	174.6	176.4	174.9	174.5	174.7	178.7	....
10	....	175.8	175.9	175.0	174.5	174.6	178.2	....
11	....	175.3	175.5	175.2	174.5	174.7	177.7	....
12	....	175.1	175.2	175.4	174.5	175.6	177.3	....
13	....	175.0	175.5	175.3	174.5	175.8	177.3	....
14	....	174.8	175.4	175.3	174 4	175.6	177.2	....
15	....	174.7	175.3	175.2	174.3	175.5	177.8	....
16	....	174.7	175.2	175.2	174.4	175.6	177.3	....
17	....	174.7	175.1	175.0	174.4	175.7	177.2	....
18	....	174.6	175.0	175.1	174.4	175.7	177.1	....
19	....	174.6	175.1	175.5	174.4	175.9	177.1	....
20	....	174.7	175.1	175.3	174 5	176.2	177.0	....
21	174.4	175.7	175.1	174.9	174.5	176.7	177.4	....
22	174.3	176.2	175.0	174.7	174.4	179.2	181.0	....
23	174.3	176.0	175.1	174.9	174.4	177.7	179.8	....
24	174.3	175.7	175.1	175 3	174.4	177.7	179.2	....
25	174.3	175.5	175.6	175.1	174.4	177.7	179.5	....
26	175.0	176.3	176.5	175.0	174.4	178.8	179.5	....
27	175.0	178.7	176.0	174.8	174.3	179.8	177.9	....
28	174.8	178.6	175 8	174.7	174.3	179.6	177.1	....
29	174.7	177.7	175.6	174.7	....	178.6	176.7	....
30	174.7	176.7	175.4	174.8	....	177.4	176.4	....
31	174.6	....	175.3	174.7	....	177.0	....	....

Mean Daily Elevation of Water Surface of Mohawk River at Fischer's Ferry, Gauge No. 4.

DAY.				1901.			
			...n.	Jan.	Feb.	Mar.	Apr.
			.1	177.6	176.4	175.7	177.5
			.6	177.7	176.3	175.7	177.6
			.3	178.0	176.1	175.6	177.2
			.1	177.6	[illegible]	175.7	179.5
			.1	177.3	176.0	175.7	180.2
			.3	177.3	176.0	175.8	180.5
			.5	177.2	175.9	175.9	181.0
			.3	177.2	175.8	176.0	182.2
			.0	177.5	176.0	175.9	181.2
			.0	177.5	176.1	176.0	180.3
			[illegible]	177.0	175.8	176.6	179.3
			[illegible]	178.0	176.1	177.5	180.3
			.9	177.8	[illegible]	177.0	179.6
			.0	177.8	175.9	177.3	178.6
			[illegible]	177.7	175.8	177.3	178.6
			.1	177.6	175.9	177.4	179.7
			.7	177.0	[illegible]	177.3	178.4
18	....	174.0	177.7	177.5	175.9	177.4	178.3
19	....	174.0	177.7	177.6	175.8	177.7	178.4
20	....	174.9	177.7	177.6	175.7	178.4	178.3
21	....	176.1	177.8	177.0	175.9	178.7	178.9
22	....	176.7	177.7	176.9	175.9	182.3	186.5
23	174.2	176.6	177.7	177.0	175.8	179.6	183.4
24	174.3	176.1	177.7	177.4	175.7	179.5	182.2
25	174.3	175.9	178.4	177.3	175.7	179.5	182.5
26	175.1	177.1	179.5	177.0	175.7	181.6	182.7
27	175.3	181.0	178.8	177.0	175.7	182.5	179.7
28	174.8	180.5	178.6	176.5	175.3	182.0	179.4
29	174.6	179.5	178.0	178.4	....	180.0	177.0
30	174.0	177.9	178.0	176.5	....	178.8	177.1
31	174.6	....	177.6	176.4	....	178.1	....

Mean Daily Elevation of Water Surface of Mohawk River at Rexford Flats, Gauge No. 6, Below Dam.

DAY.	1900.			1901.			
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	....	204.0	205.5	204.9	204.6	204.5	207.5
2	....	204.2	205.4	204.8	204.6	204.5	207.7
3	....	204.1	205.4	204.8	204.5	204.5	207.6
4	....	204.1	206.2	204.7	204.5	204.5	206.6
5	....	204.0	206.1	204.6	[illegible]	204.6	207.0
6	....	204.0	206.0	204.6	204.4	204.5	207.1
7	....	204.0	205.8	204.6	204.4	204.5	211.1
8	....	204.1	205.7	204.4	204.4	204.6	210.3
9	....	205.0	205.6	204.4	204.6	204.6	211.5
10	....	205.5	....	204.7	204.6	204.6	212.3
11	....	205.2	....	204.8	204.5	204.8	213.8
12	....	204.9	....	204.9	204.5	205.5	213.1
13	....	204.8	....	204.5	204.5	205.6	213.2
14	....	204.6	....	204.8	204.5	205.3	209.1
15	....	204.6	....	204.8	204.5	205.3	208.0
16	....	204.6	....	204.7	204.5	205.8	205.9
17	....	204.6	....	204.8	204.6	205.3	205.7
18	....	204.5	....	204.9	[illegible]	205.3	205.6
19	....	204.6	....	204.8	204.5	205.5	205.5
20	....	204.8	....	204.8	204.5	205.0	205.5
21	204.2	205.5	....	204.8	204.5	206.1	205.0
22	204.2	205.7	....	204.8	204.6	208.3	214.7
23	204.2	205.6	....	204.8	204.5	206.7	213.6
24	204.2	205.3	204.7	205.0	204.4	206.5	212.6
25	204.1	205.3	204.8	204.9	204.3	206.6	212.6
26	205.0	206.0	204.9	204.8	[illegible]	209.3	210.6
27	204.9	208.8	204.8	205.4	[illegible]	....	208.4
28	204.6	208.1	204.7	205.2	204.3	210.3	207.6
29	204.3	206.8	[illegible]	205.1	....	208.3	207.1
30	204.3	205.9	204.8	204.7	....	207.0	206.3
31	204.1	....	204.8	204.6	....	207.1	....

Mean Daily Elevation of Water Surface of Mohawk River Above State Dam at Rexford Flats, Gauge No. 6.

DAY.	1900.			1901.			
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	208.9	209.3	210.9	209.9	209.3	209.3	211.1
2	208.8	209.2	210.6	209.8	209.2	209.3	210.9
3	208.8	209.3	210.4	209.8	209.2	209.3	211.0
4	208.8	209.3	210.3	209.6	209.2	209.3	212.4
5	208.8	209.2	210.8	209.5	209.1	209.4	212.8
6	208.8	209.2	211.5	209.4	209.1	209.4	213.0
7	208.8	209.2	211.2	209.4	209.1	209.3	213.8
8	208.8	209.2	211.0	209.3	209.3	209.3	214.6
9	208.8	209.9	210.8	209.4	209.4	209.3	213.3
10	208.8	210.4	......	209.6	209.2	209.4	212.8
11	208.8	210.0	......	209.7	209.2	209.6	212.2
12	208.8	209.8	......	209.8	209.3	210.3	212.0
13	208.9	209.6	......	209.8	209.3	210.4	211.7
14	208.9	209.5	......	209.7	209.3	210.2	211.7
15	209.0	209.3	......	209.7	209.4	210.2	211.7
16	209.0	209.4	......	209.8	209.4	210.3	211.7
17	209.0	209.4	......	209.9	209.4	210.3	211.6
18	209.0	209.2	......	210.0	209.6	210.3	211.6
19	208.9	209.3	......	209.9	209.5	210.5	211.5
20	208.9	209.5	......	209.8	209.4	210.9	211.5
21	209.0	210.5	......	209.7	209.5	211.1	211.8
22	209.0	210.8	......	209.8	209.4	213.4	216.4
23	209.0	210.6	......	209.7	209.5	212.2	214.7
24	209.0	210.3	210.0	209.8	209.3	212.3	213.9
25	209.0	210.3	210.2	209.8	209.2	212.3	214.6
26	209.3	211.3	210.4	209.6	209.2	213.9	214.4
27	209.8	213.4	210.3	210.3	209.2	215.0	212.4
28	209.7	213.2	210.2	210.3	209.2	214.2	211.5
29	209.6	212.2	210.1	209.6	......	213.6	211.2
30	209.5	211.4	209.8	209.3	......	211.8	210.8
31	209.4	......	209.8	209.2	......	211.4	......

Mean Daily Elevation of Water Surface of Mohawk River at Schenectady, N. Y., Gauge No. 8.

DAY.	1900.			1901.						
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	209.0	209.3	211.6	210.1	209.7	209.4	212.0	211.5	211.7	209.3
2	209.0	209.4	211.1	210.1	209.5	209.3	211.5	211.2	211.9	209.3
3	209.0	209.3	210.8	209.8	209.4	209.3	211.5	211.1	212.2	209.3
4	209.0	209.3	210.5	209.6	209.4	209.3	213.8	211.0	212.0	200.2
5	209.0	209.2	212.5	209.9	209.4	209.4	214.4	210.6	211.6	209.2
6	209.0	209.2	212.6	209.6	209.3	209.5	214.5	210.3	211.1	209.3
7	208.8	209.1	211.9	209.5	209.3	209.5	215.3	210.0	212.2	210.2
8	208.9	209.1	211.8	209.7	209.3	209.5	217.7	209.9	213.9	210.1
9	208.9	210.2	211.5	209.6	209.4	209.4	215.3	209.8	212.6	209.9
10	208.9	210.3	211.0	209.7	209.4	209.5	214.5	209.7	211.9	209.6
11	208.9	210.4	210.5	210.1	209.3	210.1	213.6	210.0	211.3	209.5
12	208.9	209.9	209.9	210.2	209.5	210.3	213.0	211.5	210.7	209.5
13	208.9	209.6	210.5	210.4	209.4	211.3	212.8	212.3	210.4	209.4
14	209.0	209.6	210.6	210.1	209.4	210.8	212.8	212.2	210.1	209.4
15	208.9	209.5	210.0	210.0	209.4	210.7	212.3	211.5	210.0	209.3
16	208.9	209.5	209.8	209.9	209.3	210.9	212.9	210.9	209.8	209.2
17	209.0	209.4	209.6	209.9	209.5	210.9	212.7	210.5	209.6	209.2
18	209.0	209.3	209.7	210.1	209.4	211.8	212.6	211.4	209.5	209.3
19	209.2	209.4	209.7	210.0	209.3	211.1	213.7	211.2	209.4	209.5
20	209.1	209.6	209.8	209.8	209.4	211.7	212.5	211.4	209.4	209.4
21	209.0	210.7	209.9	210.2	209.4	212.1	212.8	211.4	209.4	......
22	209.0	211.4	210.0	209.7	209.5	216.2	220.4	211.0	210.1	......
23	209.0	211.1	209.9	209.7	209.4	214.6	217.3	210.7	211.5	......
24	209.0	210.8	209.9	210.0	209.3	218.8	216.3	211.0	211.8	......
25	209.0	210.5	210.5	209.9	209.3	218.7	217.0	211.0	211.3	......
26	209.9	212.2	211.8	209.8	209.3	216.0	217.0	210.8	210.9	......
27	209.8	215.4	211.4	209.7	209.2	217.3	213.8	210.5	210.0	......
28	209.5	215.1	210.8	210.5	209.3	217.2	212.6	210.6	209.7	......
29	209.4	213.8	210.5	210.2	......	215.3	211.9	212.0	209.5	......
30	209.5	212.3	210.2	209.4	......	213.3	211.5	211.9	209.4	......
31	209.4	......	210.0	209.7	......	212.4	......	212.1	......	......

Mean Daily Elevation of Water Surface of Mohawk River at Hoffman's Ferry. Gauge No. 9.

DAY.	1900.			1901.			
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	....	235.3	239.4	237.1	235.8	235.5	239.8
2	....	235.5	238.7	236.8	235.7	235.4	239.0
3	....	235.4	238.3	236.4	235.7	235.4	240.0
4	....	235.1	238.0	235.9	235.6	235.5	242.1
5	....	235.0	241.6	235.8	235.5	235.7	243.3
6	....	234.8	240.7	236.2	235.8	236.3	243.2
7	....	234.8	240.1	236.1	235.9	236.3	244.8
8	....	235.0	239.9	236.0	236.1	236.0	245.8
9	....	236.1	238.4	236.2	236.1	235.8	244.0
10	....	236.1	238.3	236.4	236.2	236.4	242.9
11	....	237.2	237.5	237.4	236.3	237.7	241.9
12	....	236.5	237.2	237.4	235.9	238.9	241.5
13	....	236.1	237.3	237.2	236.2	238.9	241.1
14	....	235.9	237.3	237.2	236.7	238.8	241.3
15	....	235.9	237.8	236.9	236.4	238.2	241.4
16	....	235.7	238.6	236.7	236.5	238.9	241.3
17	....	235.4	238.2	236.6	235.9	239.1	241.0
18	....	235.3	238.0	236.6	235.7	238.5	240.9
19	....	235.4	238.0	236.6	235.7	239.9	241.0
20	....	236.5	238.2	236.6	235.6	240.5	240.8
21	....	239.1	238.8	236.3	235.7	241.1	242.4
22	....	239.1	238.1	236.2	235.6	245.2	243.8
23	....	238.7	237.7	237.0	235.6	241.7	246.7
24	234.4	238.0	237.5	236.9	235.7	242.1	244.8
25	235.3	237.5	240.7	236.6	235.6	242.0	246.6
26	236.7	241.6	239.9	236.2	235.8	245.2	244.6
27	236.1	244.7	239.4	236.0	235.6	246.8	242.2
28	235.5	244.0	238.4	236.0	235.6	245.7	240.5
29	235.6	241.8	237.8	235.9	....	243.6	239.9
30	235.7	240.2	237.4	236.0	....	241.3	239.4
31	235.5	....	237.0	235.9	....	240.5	....

Mean Daily Elevation of Water Surface of Mohawk River at Amsterdam, Gauge No. 10.

DAY.	1900.			1901.			
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	....	248.2	251.3	250.3	250.4	249.8	251.7
2	....	248.8	250.8	250.2	250.3	249.8	251.2
3	....	248.8	250.5	251.4	250.3	249.8	251.9
4	....	248.4	250.4	251.6	250.2	250.0	253.4
5	....	248.5	253.0	251.2	250.1	250.1	254.5
6	....	248.5	252.2	251.4	250.2	250.3	254.7
7	....	248.5	251.8	251.3	250.1	250.2	256.2
8	....	249.6	251.6	251.2	250.3	250.1	257.1
9	....	250.5	251.3	251.3	250.2	250.3	255.3
10	....	250.4	250.6	251.6	250.3	250.4	254.3
11	....	249.9	250.3	252.2	250.2	251.4	253.3
12	....	249.4	250.1	251.9	250.2	252.4	253.0
13	....	249.2	250.0	251.9	250.1	252.3	252.7
14	....	249.2	249.9	251.6	250.2	252.1	252.8
15	....	249.1	249.9	251.3	250.1	251.9	252.9
16	....	249.1	249.9	251.2	250.1	252.4	252.8
17	....	248.9	250.3	251.1	250.0	253.4	252.6
18	....	248.9	251.9	251.8	250.0	252.4	252.5
19	....	249.0	252.0	251.1	250.0	253.4	252.5
20	....	249.7	252.0	250.9	250.1	254.2	252.4
21	....	251.2	251.9	250.5	250.1	254.8	251.9
22	....	251.2	251.8	250.7	250.0	260.7	260.6
23	....	250.9	251.6	251.4	250.0	257.0	258.4
24	248.3	250.4	251.4	251.4	250.0	254.7	256.1
25	249.1	250.1	253.4	251.0	249.9	254.0	257.6
26	249.6	253.8	252.8	251.5	249.8	256.1	256.6
27	249.2	256.3	252.4	251.0	249.9	258.3	258.6
28	248.9	255.3	2 1.7	250.5	249.9	257.8	....
29	248.9	253.8	251.3	250.6	....	254.8	....
30	248.5	252.1	250.9	250.5	....	253.7	....
31	248.8	....	250.4	250.4	....	253.3	....

Mean Daily Elevation of Water Surface of Mohawk River at Fort Hunter, Gauge No. 13.

DAY.	1900.			1901.			
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	....	267.9	269.9	269.2	269.4	269.4	270.4
2	....	267.8	269.6	269.2	269.4	269.4	270.0
3	....	267.7	269.8	269.2	269.4	269.4	270.5
4	....	267.7	269.9	269.2	269.4	269.4	271.8
5	....	267.7	271.5	269.2	269.4	269.4	272.6
6	....	267.6	270.5	269.4	269.4	269.4	272.7
7	....	267.6	270.4	269.4	269.4	269.4	273.6
8	....	267.7	270.8	269.4	269.4	269.4	274.1
9	....	269.5	270.2	269.4	....	269.4	273.2
10	....	269.3	269.3	269.4	269.4	269.4	272.5
11	....	26?.7	269.8	269.4	269.4	269.7	272.4
12	....	268.3	269.1	269.4	269.4	271.4	272.0
13	....	268.2	269.3	269.4	269.4	271.3	271.7
14	....	268.1	269.2	269.4	269.4	271.1	271.6
15	....	268.1	269.2	269.4	269.4	270.9	271.6
16	....	268.0	269.2	269.5	269.4	271.2	271.5
17	....	267.8	269.1	269.4	269.4	271.4	271.4
18	....	267.8	269.1	269.4	269.4	270.7	271.4
19	....	267.8	269.1	269.4	269.4	271.4	271.4
20	....	267.9	269.1	269.4	269.4	271.6	271.4
21	....	268.0	269.1	269.4	269.4	272.6	272.2
22	....	270.0	269.1	269.4	259.4	273.1	276.2
23	....	269.9	269.1	269.4	269.4	271.6	275.0
24	....	269.5	269.1	269.4	269.4	271.8	273.8
25	268.2	272.0	270.4	269.4	269.4	271.7	275.0
26	268.5	273.7	270.2	269.4	269.4	273.2	273.3
27	268.1	273.1	270.2	269.4	269.4	274.8	272.3
28	267.9	272.2	269.5	269.4	269.4	274.3	....
29	267.9	270.6	269.3	269.4	....	272.6	....
30	267.9	270.1	269.2	269.4	....	272.2	....
31	267.9	....	269.2	269.4	....	270.9	....

Mean Daily Elevation of Water Surface of Mohawk River at Yosts, N. Y., Gauge No. 14.

DAY.	1900.			1901.			
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	....	276.4	279.9	278.2	277.5	277.4	280.5
2	....	276.4	279.0	277.8	277.4	277.4	279.5
3	....	276.3	278.5	277.5	277.4	277.5	281.0
4	....	276.1	278.3	277.2	277.4	277.5	283.0
5	....	275.9	282.0	277.2	277.4	277.6	283.7
6	....	275.9	280.8	277.3	277.4	277.9	283.1
7	....	276.0	280.5	277.4	277.6	277.7	284.2
8	....	276.4	280.3	277.5	277.8	277.4	285.0
9	....	279.4	280.1	277.7	277.8	277.6	284.7
10	....	278.7	278.6	278.9	277.7	278.4	283.6
11	....	277.7	277.8	279.1	277.6	279.0	282.7
12	....	277.0	278.9	279.1	277.5	280.0	282.0
13	....	276.8	278.8	279.0	277.7	280.0	281.7
14	....	276.6	279.1	278.7	277.7	279.7	281.9
15	....	276.5	278.4	278.6	277.7	279.5	282.3
16	....	276.3	278.1	278.5	277.6	280.1	282.3
17	....	276.2	278.1	278.5	277.5	280.2	281.8
18	....	276.1	278.1	278.9	277.5	279.8	282.0
19	....	276.4	278.0	278.6	277.5	281.7	282.0
20	....	278.0	278.4	278.1	277.6	281.4	281.7
21	....	280.2	278.4	277.8	277.6	283.0	2?1.7
22	....	280.0	278.3	278.1	277.5	285.8	286.0
23	....	279.5	278.1	278.6	277.6	285.1	....
24	....	278.7	278.2	278.6	277.5	285.4	285.5
25	....	278.1	280.9	278.3	277.4	285.4	286.0
26	....	284.3	281.1	278.1	277.4	287.2	282.8
27	....	286.6	280.4	277.9	277.5	289.2	281.5
28	....	286.4	279.4	277.7	277.5	288.2	....
29	276.7	28?.9	278.8	277.6	....	284.9	....
30	276.5	281.3	278.3	277.5	....	282.7	....
31	276.3	....	278.1	277.5	....	281.4	....

Mean Daily Elevation of Water Surface of Mohawk River at Canajoharie, N. Y., Gauge No. 15.

DAY.	1900. Oct.	1900. Nov.	1900. Dec.	1901. Jan.	1901. Feb.	1901. Mar.	1901. Apr.
1	....	286.2	288.1	287.8	286.2	285.9	289.4
2	....	285.8	288.6	287.	286.1	286.	289.7
3	....	285.7	287.	286.2	286.1	286.	290.2
4	....	285.7	287.3	286.4	286.1	286.	291.5
5	....	285.4	289.3	286.1	286.	286.2	292.1
6	....	285.4	289.2	286.1	286	286.3	291.5
7	....	284.8	289.5	286.1	286.	286.2	292.5
8	....	284.8	289.	286.5	285.9	286.1	293.1
9	....	289.4	288.7	287.1	285.9	286.2	293.1
10	....	287.8	288.1	288.1	285.9	287.	292.1
11	....	287.7	288.5	288.5	285.9	287.7	291.1
12	....	286.3	288.8	287.8	285.9	288.4	290.4
13	....	286.2	291.	288.1	285.9	288.4	290.4
14	....	286.3	290.4	287.4	285.9	288.4	290.8
15	....	286.2	288.7	287.4	285.9	288.2	291.3
16	....	285.6	289.3	287.	285.9	288.5	291.1
17	....	285.5	289.2	286.4	286.	290.5	290.5
18	....	285.7	287.7	286.2	286.1	288.4	291.
19	....	286.1	287.2	286.2	286.2	289.2	290.9
20	....	286.9	288.2	286.4	286.2	289.	290.4
21	....	288.2	288.	286.5	286.2	291.7	290.4
22	....	287.8	287.7	287.2	286.2	293.5	293.5
23	....	288.4	287.9	287.1	286.2	293.	294.9
24	....	287.9	288.	286.8	286.1	292.8	293.6
25	286.9	287.4	290.4	286.9	285.9	292.9	292.9
26	286.2	293.3	291.1	286.5	286.	292.9	291.5
27	285.9	294.7	290.	286.5	286.1	296.1	290.5
28	283.9	294.5	289.1	286.5	285.9	296.	289.7
29	285.9	291.6	288.2	286.2	....	293.	288.7
30	285.8	289.7	287.9	286.2	....	291.4	287.9
31	286.3	....	287.8	286.2	....	290.3	....

Mean Daily Elevation of Water Surface of Mohawk River at St. Johnsville, Gauge No. 16.

DAY.	1900. Oct.	1900. Nov.	1900. Dec.	1901. Jan.	1901. Feb.	1901. Mar.	1901. Apr.
1	....	298.9	301.8	300.2	299.9	....	302.1
2	....	298.9	301.1	299.9	300.0	....	301.6
3	....	298.7	300.6	299.6	299.9	299.6	302.6
4	....	298.5	300.7	299.5	299.9	299.6	304.0
5	....	298.4	303.2	299.6	300.0	299.6	304.3
6	....	298.4	302.4	299.8	300.2	299.6	304.6
7	....	298.5	302.4	299.6	300.3	299.6	305.0
8	....	299.9	302.2	299.8	300.3	299.6	305.6
9	....	302.4	301.5	300.8	300.1	299.7	305.0
10	....	301.6	300.6	301.1	300.0	300.0	304.6
11	....	300.1	300.0	301.2	300.0	300.4	303.5
12	....	299.4	300.0	301.0	299.9	300.9	303.2
13	....	299.2	300.2	300.8	299.9	301.1	303.2
14	....	299.2	299.7	300.6	299.9	301.0	....
15	....	299.2	301.6	300.4	299.9	300.9	....
16	....	298.8	301.3	300.4	299.9	301.3	....
17	....	298.7	301.0	300.5	299.8	301.2	....
18	....	298.6	300.6	300.8	299.9	300.9	....
19	....	299.8	300.8	300.5	299.9	302.3	....
20	....	301.9	301.0	300.8	300.0	302.0	....
21	....	303.4	301.0	300.2	299.9	304.0	....
22	....	302.9	300.4	300.8	299.9	305.6	....
23	....	302.2	300.2	300.8	299.7	307.0	....
24	....	301.0	301.1	300.6	....	308.2	....
25	....	301.1	303.0	300.4	....	308.0	....
26	....	307.6	303.0	300.3	....	307.9	....
27	....	308.2	302.2	300.2	....	310.1	....
28	299.1	307.6	301.1	300.1	....	309.1	....
29	299.1	303.8	300.6	300.1	....	305.8	....
30	298.9	302.6	300.5	300.1	....	304.0	....
31	298.7	....	300.2	300.0	....	302.9	....

Mean Daily Elevation of Water Surface of Mohawk River at Rocky Rift Dam, Gauge No. 17.

DAY.	1900. Oct.	1900. Nov.	1900. Dec.	1901. Jan.	1901. Feb.	1901. Mar.	1901. Apr.
1	....	816.6	819.3	....	816.7	816.6	819.1
2	....	816.7	818.6	....	816.6	816.6	819.0
3	....	816.5	818.2	....	816.6	816.6	819.5
4	....	816.4	818.1	....	816.6	816.6	821.1
5	....	816.3	819.9	....	816.7	816.6	821.3
6	....	816.3	820.0	....	816.8	816.7	821.4
7	....	816.4	820.7	....	816.9	816.8	821.7
8	....	818.2	820.1	817.3	816.9	817.1	822.4
9	....	819.7	819.3	817.4	817.0	817.1	822.8
10	....	818.6	818.5	818.1	816.9	817.3	822.2
11	....	817.7	817.9	818.3	816.8	817.6	820.9
12	....	817.1	817.8	818.1	816.8	817.9	820.4
13	....	817.1	817.6	818.0	816.9	817.8	820.3
14	....	816.9	817.5	817.7	817.2	817.7	820.3
15	....	816.9	817.3	817.5	817.1	817.9	820.3
16	....	816.8	817.2	817.4	816.8	817.9	820.2
17	....	816.6	817.2	817.5	816.7	818.0	820.3
18	....	816.6	817.1	816.9	816.7	818.1	820.3
19	....	817.0	817.3	817.3	816.7	819.2	820.4
20	....	818.9	817.6	817.3	816.7	819.8	820.1
21	....	820.2	817.6	816.8	816.6	821.4	820.2
22	....	819.2	817.5	817.0	816.5	821.7	822.1
23	....	819.2	817.5	817.5	816.5	822.1	824.3
24	....	818.5	818.5	817.2	816.5	821.6	823.7
25	....	819.4	819.6	816.8	816.5	821.5	822.2
26	....	824.0	819.7	817.3	816.5	822.7	820.8
27	....	825.3	819.2	817.0	816.5	824.2	820.1
28	816.7	824.7	818.6	816.8	816.5	823.7	819.6
29	816.9	822.1	817.8	816.7	....	822.4	819.4
30	816.7	820.0	817.5	816.7	....	821.2	819.3
31	816.8	....	817.5	816.7	....	820.1	....

Mean Daily Elevation of Water Surface of Mohawk River above Crest of Rocky Rift Dam, Gauge No. 18.

DAY.	1900. Oct.	1900. Nov.	1900. Dec.	1901. Jan.	1901. Feb.	1901. Mar.	1901. Apr.
1	....	822.1	823.9	....	821.8	820.2	821.8
2	....	822.1	822.6	....	821.8	820.2	821.9
3	....	822.0	822.4	....	821.8	820.1	822.5
4	....	821.9	822.4	....	821.8	820.0	823.5
5	....	821.8	823.1	....	821.8	820.0	823.4
6	....	821.8	823.2	....	821.8	820.0	822.8
7	....	821.9	823.2	....	821.8	820.1	823.0
8	....	822.8	823.1	821.9	821.8	820.3	823.1
9	....	823.3	822.6	822.2	821.8	820.3	823.2
10	....	822.7	822.2	822.3	821.7	820.4	822.9
11	....	822.3	822.1	822.4	821.7	820.8	822.7
12	....	821.9	822.2	822.4	821.6	820.8	822.8
13	....	821.9	822.1	822.3	821.6	820.8	822.3
14	....	821.9	822.0	822.2	821.8	820.8	822.8
15	....	821.9	872.0	822.0	821.8	820.8	822.6
16	....	821.8	821.9	822.1	821.7	820.9	822.4
17	....	821.7	822.0	822.2	821.6	820.8	822.5
18	....	821.7	821.9	822.0	821.6	821.1	822.5
19	....	821.9	822.0	821.8	821.6	821.8	822.5
20	....	822.8	822.1	821.8	821.5	821.8	822.6
21	....	823.4	822.2	822.0	821.1	823.1	822.2
22	....	823.1	822.0	822.2	820.6	823.1	823.5
23	....	822.8	822.1	822.3	820.3	823.0	824.2
24	....	822.5	822.5	822.0	820.3	822.9	824.4
25	....	822.6	823.0	822.0	820.3	822.9	823.3
26	....	825.5	823.1	821.9	820.3	824.3	823.6
27	....	826.5	822.9	821.8	820.3	825.3	822.4
28	822.1	826.2	822.5	831.8	820.3	825.0	822.0
29	822.2	824.5	822.2	821.8	....	823.5	821.8
30	822.1	823.3	822.1	822.0	....	822.8	821.8
31	822.0	....	822.1	822.1	....	822.0	....

Mean Daily Elevation of Water Surface of Mohawk River above Little Falls State Dam, Gauge No. 23.

DAY.	1900.			1901.			
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	....	363.8	364.9	364.2	363.8	363.8	365.0
2	....	363.8	364.6	364.2	363.7	363.9	364.8
3	....	363.7	364.4	364.1	363.8	364.0	365.5
4	....	363.7	364.5	364.0	363.8	364.0	365.8
5	....	363.8	365.5	363.9	363.8	363.9	365.8
6	....	363.6	365.2	363.9	363.7	363.8	365.7
7	....	363.7	365.4	363.9	363.8	363.8	366.0
8	....	364.6	365.2	363.9	363.8	363.8	366.3
9	....	365.3	364.8	364.3	363.9	363.9	366.4
10	....	364.7	364.2	364.4	363.9	364 2	366.1
11	....	364 3	363.9	364.4	363.9	364.2	365.7
12	....	364.0	364.2	364.4	363.9	364.3	365.5
13	....	363 9	364.1	364.3	363.8	364.4	365.5
14	....	363.9	364.0	364.1	363.8	364.4	365.6
15	....	363.9	364.0	364.2	363.8	364.4	365.4
16	....	363.8	364.1	364.2	364 0	364.4	365.6
17	....	363.7	364.0	364.2	363.9	364.4	365.6
18	....	362.8	364.0	364.3	363.9	364.3	365.7
19	....	364.0	364.0	364.1	363.9	364.7	365.6
20	....	365.0	364.1	364.0	363 9	364.7	365.4
21	....	365.6	364.2	363.9	363.9	365.3	365.3
22	....	365.5	364.2	364.1	363.8	365.8	366.6
23	....	365.0	364.3	364.1	363.8	366.1	366.6
24	....	364.6	364.7	364.1	363.9	366.0	366.4
25	....	364.9	365.0	364.1	363 9	366.1	366.2
26	....	367.5	365.2	364.0	363 9	367.4	365.9
27	......	368.1	365.1	363.8	363.8	369.1	365.5
28	363.9	367.5	364.5	363.9	363.8	368.6	....
29	364.0	366.0	364.4	363.8	....	367.2	....
30	363 8	365.4	364.2	363.9	....	366.1	....
31	363.8	....	364.3	363.8	....	365.5	....

Mean Daily Elevation of Water Surface of Mohawk River at Herkimer N. Y., Gauge No. 24.

DAY.	1900.			1901.			
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April.
1	....	375.5	380.1	....	377.6	382 6	378.1
2	....	375.2	377.1	....	378.3	381.6	378.6
3	....	374.7	377.4	....	378.2	381.1	380.1
4	....	....	378.0	....	377.6	380.6	380.1
5	....	....	378.6	....	377.4	379.6	380.6
6	....	375.6	379.2	....	377.1	379.6	380.8
7	....	376.2	379.2	....	377.6	378.6	381.2
8	....	377.4	377.9	377.6	378.3	378.6	381.5
9	....	378 3	377.3	377.6	378.6	383.6	381.1
10	....	377.3	377.0	377.6	378.3	377.3	380.6
11	....	376.5	377.0	378.1	378.3	378.4	360.6
12	....	375.9	377.1	378.6	378.1	378.5	380.1
13	....	375.4	377.6	377.9	377.9	378.5	379.6
14	....	375.3	377.6	377.8	377.3	377.6	379.1
15	....	375.1	377.8	377.6	376.9	377.1	378.6
16	....	375.5	377.6	377.8	376.6	377.6	378.6
17	....	375.5	377.8	378.4	377.0	378.1	378 6
18	....	374.5	377.8	378.2	377.0	378.6	378.4
19	....	376.0	378.9	378.4	377.1	379.6	378.4
20	....	376.7	379.3	378.4	377.4	381.4	378.4
21	....	377.3	379.2	378.8	377.3	382.6	....
22	....	378.5	379.1	378.8	377.2	380.9	....
23	....	378.5	378.8	377.6	376.8	380.2	....
24	....	378.6	378.6	376.8	376.8	380.5	....
25	....	379 3	379.4	376.6	376.6	381.4	....
26	....	382.6	379.1	377.2	376.6	383.1	....
27	....	383.9	378.9	377.2	383.6	384.7	....
28	375.3	383 2	378.6	377.4	382.6	384.2	....
29	375.2	382.0	378 0	377.9	....	382.9	....
30	374.8	380.6	....	376.4	....	382.3	....
31	374.8	....	....	378.1	....	378.4	....

Location of Mohawk River Slope Gauges.

Gauge number.	LOCATION.	Elevation of gauge zero.	Difference of elevation of gauge zeros.
1	Above Cohoes Company's dam	150.95	....
2	Below West Troy Company's dam, Dunsbach Ferry	164.30	13.35
3	Above West Troy Company's dam, Dunsbach Ferry	172.28	7 93
4	Vischer's Ferry bridge	174.09	1.86
5	Below Rexford Flats dam	204.38	30.29
6	Above Rexford Flats dam	208.35	3.97
8	Freeman's bridge, Schenectady	203.76	—4.59
9	Hoffman's ferry	232.56	28.80
10	Amsterdam	248.45	15.89
13	Fort Hunter	267.56	19.11
14	Yosts	274.69	7.13
15	Canajoharie	284.68	9.99
16	St. Johnsville	297.37	12.69
17	Below Rocky Rift dam	315.40	18 03
18	Above Rocky Rift dam	319.78	4.38
19	Below Little Falls Paper Company's mill	321.00	1.22
22	Above Gilbert's dam, Little Falls, N. Y	333.81	12.81
23	Above New York State dam, Little Falls, N. Y	362.29	28 48

During the severe winter months the river was frozen over throughout the greater portion of its length, the greatest depth of ice at the gauging stations varied from two to three feet. When the river surface was frozen, holes were chopped through the ice around the gauges. At such times the readings show the elevation of the water surface as it rose in these openings.

Readings were not taken at simultaneous hours at the different stations. In reducing the records, the means of the two daily readings at each station have been used to determine the fall and surface slope from station to station. The accompanying tables show the resulting mean elevation of water surface at the principal stations.

Gauge No. 1.—Above Cohoes Company's dam; record from October 28, 1900, to April 27, 1901, inclusive. Readings in feet and tenths were taken between 6 and 7 a. m., and again between 6 and 7 p. m. William Butler, observer. Gauge was attached vertically to cribwork back of masonry ice breaker, 150 feet upstream from right-hand end of the Cohoes Company's dam.

Gauge No. 2.—Below West Troy Company's dam; readings in feet and decimals, taken at 7 a. m. and between 4:30 and 5.30 p. m., Frederick H. Burgess, gauge reader. March 23, 1901, an

ice gorge two miles below this dam backed water to at least 17 feet on gauge No. 2 and carried away part of gauge; ice was left in piles from 10 to 12 feet high along the banks.

Gauge No. 3.—Above West Troy Company's dam; readings taken from 5 to 5.30 p. m., by Frederick Burgess. Readings to 5 feet were taken from vertical gauge attached to bulkhead above dam; readings of 5 feet or over were taken from gauge attached to face of forebay timber adjoining pump house. Gauge was divided decimally and is situated about 50 feet upstream from lower section of dam, right-hand end.

Gauge No. 4.—Vischer's Ferry bridge, L. S. Clute, observer, readings in feet and decimals, taken at 6 a. m. and from 5 to 6 p. m. December 7, 1900, river became blocked by ice, submerging the gauge. March 22, 1901, 3.30 a. m., an ice gorge broke away; maximum gauge reading 14.0 feet.

Gauge No. 5. Below Rexford Flats dam, H. R. Betts, observer. Record from October 21, 1900, to May 4, 1901, inclusive; readings in feet and tenths. Gauge was attached to lower end face of the right-hand abutment of dam. Gauge carried away by high water March 27, 1901, and measurements from that date were made in feet and inches from corner of bulkhead down to water surface.

Gauge No. 6.—Fifty feet above Rexford Flats dam, H. R. Betts observer; gauge divided decimally.

Gauge No. 9.—Mohawk River at Hoffman's Ferry, L. D. Phillips, observer; readings taken at 9 a. m. and 5 p. m. in feet and decimals, from October 24, 1900, to April 30, 1901. Gauge board in three sections, attached vertically to trees on left bank 50 feet upstream from ferry cable.

Gauge No. 10.—Amsterdam, on Mohawk River, E. Simkins, observer; readings taken in feet and decimals at 7.30 a. m. and 4.30 p. m. from October 24, 1900, to April 27, 1901, inclusive. Owing to breaking up of ice, the water rose on March 22, 1901, and broke gauge at 7.6 foot elevation; all readings after that date above 7.6 were estimated from the noted position of points on the bridge pier. Gauge was attached vertically to east end of north pier of highway bridge.

Guage No. 13.—Mohawk River at Fort Hunter. A vertical gauge board divided decimally was attached to downstream face of north abutment of suspension bridge. John Brown, observer. Readings usually taken at 8 a. m. and 5 p. m. from October 25, 1900, to April 27, 1901, inclusive.

Gauge No. 14.—Mohawk River at Yosts, Fred Birch, gauge reader. Gauge board attached vertically to tree on left-hand bank of stream 500 feet below railroad station. Readings taken in feet and decimals, at 8 a. m. and 4 p. m. each day from October 29, 1900, to April 27, 1901, inclusive. April 23, 1901, gauge submerged by high water; reading about 13.6 feet.

Gauge No. 15.—Canajoharie or Palatine Bridge, William Hout, observer. Readings in feet and decimals taken at 7 a. m. and 5 p. m., from October 25, 1900, to April 30, 1901. Gauge board attached vertically to second pier from right bank, Palatine Bridge. December 13, 1900, river was blocked with ice. River surface became frozen December 15, 1900. March 26, 1901, ice broke up and water rose above top of gauge.

Gauge No. 16.—On Mohawk River at St. Johnsville, W. B. Bucklin, observer. Readings taken in feet and decimals at 7.30 a. m. and 4.30 p. m., October 28, 1900, to April 13, 1901, inclusive, except February 24th to March 2, 1901. Gauge board was attached vertically to face of old bridge abutment on left-hand side of stream, 50 feet above present highway bridge.

Gauge No. 17.—Below Rocky Rift dam, five miles below Little Falls, J. H. Nickerson, observer. A vertical gauge board divided decimally was attached to a basswood tree 100 feet above the mouth of Crum Creek and about 280 feet below Rocky Rift dam. Readings taken from 7.30 to 9.20 a. m. and usually at 4 to 5 p. m. from October 28, 1900, to April 30, 1901, inclusive.

Gauge No. 18.—Gauge board was attached vertically to left-hand abutment of dam, 18 feet upstream from crest, divided decimally. Readings were taken at the same time as those of gauge No. 17.

Gauge No. 19, in tailrace of Little Falls Paper Company's mill. 800 feet downstream from Gilbert's dam. Gauge divided

in feet and inches. Reading taken once each day by William Hoffman.

Gauge No. 23.—Above New York State dam at Little Falls. Charles B. Edic, observer. Readings in feet and decimals, usually at 8 a. m. and 5 p. m.

Gauge No. 24.—Mohawk River at Herkimer. Gauge attached to face of north abutment of Washington Street highway bridge.

In order to compute the results, the river has been divided into thirteen slope sections, each covering the portion of the river between two successive gauges. The line of gauges extended from the Washington Street bridge at Herkimer to the dam of the Cohoes Water Power Company. Throughout their entire length the slope sections are paralleled by Erie Canal. The records were not maintained during the season of canal navigation. However, the canal intercepts some run-off, which is usually carried in the canal to the nearest aqueduct or waste weir and there turned into the river. There are ten waste weirs in this portion of the canal.

At the entrance of every important tributary, a gravel bar has been formed extending into or across the channel of the Mohawk and forming a sort of submerged dam over which a rift appears in low water. Many low-lying islands obstruct the stream channel. These for the most part are submerged during high water.

Slope Section No. 1 extends from Herkimer to Little Falls State dam, a distance of 7.5 miles. The stream is tortuous, and contains a number of large islands. The channel is in earth throughout and the stream bed is of earth, gravel and cobble. It is bordered by extensive flood plains, affording surface storage during freshets. Backwater from Little Falls State dam affects the current throughout much of the length of the section.

One-half mile below the Herkimer gauge West Canada Creek enters the Mohawk, contributing the run-off from a drainage area of 569 square miles. The only other tributary of consequence is Beaver Brook, entering from the north in the middle of the section.

Slope Section No. 2 extends from the foot of the rapids below the lower or Gilbert dam in Little Falls to Rocky Rift or Five Mile feeder dam of New York State canals. The section is 4.1 miles in length. With the exception of the first mile, which is rocky, the stream channel is fairly straight and uniform. There is very little fall in this section, owing to backwater from Rocky Rift dam. The stream banks are overflowed in high water. The entering tributaries are small and quite uniformly distributed through the length of the slope section. The largest is Noudaga Creek. Its watershed lies south of the river near the head of the slope section.

Elements of Mohawk River Slope Sections.

Number.	From	To	Length, feet.	Drainage Area—Square Miles.			
				Head.	Foot.	Difference.	Mean.
1	Herkimer	Little Falls State dam.	39,789	701	1,296	595	998½
2	Gilbert's dam	Rocky Rift dam	21,864	1,306	1,337	31	1,321½
3	Rocky Rift dam	St. Johnsville	30,996	1,337	1,687	350	1,362
4	St. Johnsville	Canajoharie	46,964	1,687	1,862	175	1,774½
5	Canajoharie	Yosts	35,223	1,862	2,003	141	1,932½
6	Yosts	Fort Hunter	54,140	2,003	3,094	1,091	2,548½
7	Fort Hunter	Amsterdam	28,048	3,094	3,196	102	3,145
8	Amsterdam	Hoffmans Ferry	35,875	3,196	3,248	52	3,222
9	Hoffmans Ferry	Schenectady	60,658	3,248	3,311	63	3,279½
10	Schenectady	Rexford Flats	14,350	3,311	3,385	74	3,348
11	Rexford Flats	Vischers Ferry	27,410	3,385	3,408	23	3,396½
12	Vischers Ferry	West Troy Co.'s dam.	22,830	3,408	3,440	32	3,424
13	West Troy Co.'s dam.	Cohoes Co.'s dam	28,048	3,440	3,465	25	3,452½

Mean Elevation of Stream Bed, Mohawk River Slope Sections.

Number.	From	To	Number of cross-sections.	Average elevation of stream bed.	Average width of stream bed.
1	Herkimer	Little Falls State dam	97	362.14	303
2	J. J. Gilbert's dam	Rocky Rift dam	....	....	....
3	Rocky Rift dam	St. Johnsville	85	304.44	318
4	St. Johnsville	Canajoharie	60	288.28	380
5	Canajoharie	Yosts	56	273.76	295
6	Yosts	Fort Hunter	85	263.62	448
7	Fort Hunter	Amsterdam	37	256.99	675
8	Amsterdam	Hoffmans Ferry	50	235.50	595
9	Hoffmans Ferry	Schenectady	83	211.82	470
10	Schenectady	Rexford Flats	22	200.80	655
11	Rexford Flats	Vischers Ferry	48	185.10	535
12	Vischers Ferry	Dunsbach Ferry	37	166.73	458
13	Dunsbach Ferry	Cohoes Company's dam	44	152.33	302

Slope Section No. 3 extends from the foot of the rapids below Rocky Rift dam to a point about fifty feet above St. Johnsville highway bridge. East Canada Creek enters the section from the north, halfway between the two terminal gauging stations. The drainage area of East Canada Creek is 283 square miles. Other tributaries entering from the north are Crum Creek, Klock Creek and Zimmerman Creek. Tributaries from the south or canal side are unimportant.

The stream channel is fairly straight, containing occasional islands. The length of the section is 5.8 miles.

Slope Section No. 4 lies between the St. Johnsville and Canajoharie highway bridges; its length is 8.9 miles. Canajoharie Creek, draining an area of 69 square miles, enters on the south 500 feet below the head of the section. Otsquaga Creek, having a drainage area of 54 square miles, enters from the south at Fort Plain near the middle of the section. On the north side of the stream the only important tributary is Garoga Creek. This stream has a drainage area of 89 square miles. It flows into Mohawk River three miles below St. Johnsville. The river flows in a fairly uniform channel with occasional islands, and is bordered by a narrow flood plain.

A high water mark near Palatine Bridge at the head of the section shows the water to have risen to elevation 304.2, as the result of an ice gorge in the spring of 1893.

Slope Section No. 5, from Canajoharie bridge to a point 500 feet downstream from Yosts Station, includes a portion of the river channel 6.7 miles in length. The most important tributary is Flat Creek, draining an area of 42 square miles, which enters the Mohawk from the south at Sprakers, near the middle of the slope section. The upper portion of the section contains a number of islands.

Below Sprakers the channel is of nearly uniform width, the bends are of large radius and the regimen as a slope section good.

Slope Section No. 6, extending from the gauge near Yosts to Fort Hunter suspension bridge, comprises a stretch of the

Mohawk without islands or abrupt bends, and of nearly uniform width. It receives a number of tributaries.

NAME OF TRIBUTARY.	Distance from head of slope section, miles.	Drainage area, square miles.	Enters which side of river.
Yatesville Creek	0.0	....	South.
Briggs River	1.0	....	North.
Allston Creek	2.0	....	South.
Cayadutta Creek	5.0	62	North.
Danoscara Creek	8.5	....	North.
Aurie Creek	8.5	42	South.
Schoharie Creek	9.7	947	South.

The total length of the section is 10.2 square miles. Schoharie Creek enters one-half mile above the lower end of the slope section. Its drainage, therefore, more properly belongs to the next lower slope section. Its relatively large run-off during freshets produces backwater, reducing the effective slope of the section above. The drainage area at the foot of the section, not including Schoharie Creek, is 2,147 square miles, and the mean for the section is 2,075 square miles.

Yatesville Creek enters the Mohawk just above the upstream end of the section under consideration; its drainage area has been included in the present section to which it most properly belongs rather than in that of the section next above.

Slope Section No. 7 includes Mohawk River from Fort Hunter to Amsterdam, a distance of 5.3 miles. The stream channel is broad and for the most part divided into two parallel courses by a line of narrow islands, extending through its center. The largest tributary is South Chuctenunda Creek, which enters 1,000 feet above the downstream end of the section. Kyaderoseras Creek enters at Akin nearly mid-length of the section.

Slope Section No. 8 extends from Amsterdam to a point 50 feet upstream from Hoffman's Ferry Cable. It includes a length of 6.8 miles through which the river flows in a broad and nearly straight channel interspersed with islands. Numerous small tributaries enter from both the north and south slopes, the most important being North Chuctenunda Creek at the head of the section.

Slope Section No. 9 extends from Hoffman's Ferry to Freeman's Bridge one mile below Schenectady, a total distance of 11.3 miles. In the vicinity of Schenectady, the stream has several abandoned channels, of which Binne Kill is the largest. Through these the water flows during freshets. During low water they become stagnant lagoons, enclosing large islands. Verf Kill, Poentic Kill, and Plotter Kill, and other small tributaries enter this section.

A high water mark at Glenville Bridge, Schenectady, shows an elevation of the water surface of 220.9 feet.

Slope section No. 10 covers a length of 2.7 miles from Freeman's Bridge to the State feeder dam at Rexford Flats. The water level is controlled by the dam at the foot of the section, which forms a long, broad pond. Alplaus Kill is the only important tributary. This has a drainage area of 52 square miles, and enters from the north about one mile above the Rexford Flats dam.

At Delaware and Hudson railroad bridge, near the head of the section, the highest recorded water mark is elevation 222.9.

Slope Section No. 11, reaching from below Rexford Flats dam to Vischer's Ferry highway bridge, includes a length of the stream of 5.2 miles. The river channel is straight, of varying width and mostly free from islands. The fall is comparatively rapid. Below Rexford Flats the Erie canal crosses Mohawk river, following the left bank from Aqueduct to Crescent, where it recrosses to the right bank. The tributaries are small, Stony Kill, the largest, enters from the north near the foot of the section.

Slope Section No. 12, 4.3 miles in length, extends from Vischer's Ferry bridge to West Troy company's dam, near Dunsbach Ferry. Much of the section is included in flowage from the dam at its foot. In the upper reaches of this section the river broadens out and enfolds a number of islands. At Niskayuna the recorded flood elevation is 187.9. At Fort's Ferry the water is stated to have reached a height of 185.5 feet.

Slope Section No. 13, extending from below Dunsbach Ferry dam to Cohoes Company's dam, includes 5.3 miles of the stream. The surface level is affected by backwater from Cohoes Company's dam.

Lower Mohawk River, High-Water Marks. a

LOCATION.	Elevation.	Date.
Dunsbach Ferry bridge	187.6	Spring, 1868.
Dunsbach Ferry bridge	181.0	Ice gorge, spring 1893.
Crescent Aqueduct	179.0	Ice, spring 1868.
Crescent Aqueduct	174.3	Ordinary spring freshet.
Cohoes Company's dam	165.2	Ice freshet, spring 1868.
Cohoes Company's dam	161.9	March 16, 1889.

a From U. S. Deep Waterways maps.

Fall of Mohawk River from Gauge No. 2, below West Troy Company's Dam, to Gauge No. 1, above Cohoes Company's Dam.

DAY.	1900.			1901.			
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	......	11.10	11.75	11.20	11.15	11.35	9.90
2	......	11.05	11.25	11.30	11.10	10.90	11.05
3	......	10.85	11.45	11.15	10.65	10.75	11.90
4	......	10.70	11.40	11.05	11.20	11.10	8.80
5	......	11.05	12.18	11.05	11.32	10.95	9.45
6	......	10.95	12.10	10.85	11.35	10.90	9.80
7	......	11.00	11.85	11.05	11.34	10.95	9.20
8	......	11.15	11.90	10.95	11.82	10.80	7.10
9	......	11.30	11.55	10.80	11.46	10.75	8.65
10	......	11.65	11.20	11.05	10.56	10.70	9.75
11	......	10.95	11.60	11.30	11.60	10.85	9.45
12	......	10.95	11.45	11.20	12.08	11.30	8.65
13	......	11.05	11.60	11.15	12.03	11.50	8.60
14	......	11.00	11.30	11.10	11.99	11.25	8.65
15	......	11.10	11.10	11.25	11.95	11.25	8.70
16	......	11.07	10.95	11.20	11.93	11.25	8.75
17	......	10.90	11.15	11.20	10.60	11.25	8.75
18	......	10.70	11.15	11.40	11.53	11.35	8.85
19	......	11.00	11.20	11.50	11.97	11.70	8.85
20	......	10.90	11.25	11.25	11.98	11.85	8.90
21	......	11.40	11.15	11.05	12.09	9.95	8.15
22	......	11.60	10.95	10.85	11.97	......	......
23	11.80	11.45	11.05	11.00	11.47	......	......
24	11.30	11.40	10.85	11.20	10.65	......	7.30
25	11.85	11.20	11.00	11.09	11.15	......	6.95
26	11.12	11.55	11.90	11.05	11.30	......	7.05
27	10.95	13.25	11.65	10.90	11.40	......	10.55
28	10.85	12.90	11.60	11.10	11.35	......	......
29	11.10	12.80	11.35	11.10	......	9.10	......
30	10.95	11.85	11.10	10.80	......	8.70	......
31	11.00	......	11.05	10.90	......	9.25	......

*Fall of Mohawk River from Vischer's Ferry, Gauge No. 4, to West Troy Company's Dam, Gauge No. 3.**

DAY.	1900.			1901.			
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	------	—.04	1.86	[illegible]	[illegible]	[illegible]	[illegible]
2	------	—.04	.86	2.57	[illegible]	[illegible]	[illegible]
3	------	—.04	.46	[illegible]	[illegible]	[illegible]	.78
4	------	—.06	.38	2.78	[illegible]	1.38	1.08
5	------	—.39	[illegible]	2.66	1.38	1.36	[illegible]
6	------	—.14	[illegible]	2.38	1.46	[illegible]	2.06
7	------	—.39	.86	2.38	1.46	1.53	[illegible]
8	------	—.34	.66	[illegible]	1.46	[illegible]	2.46
9	------	[illegible]	.56	2.55	1.46	[illegible]	2.46
10	------	.38	1.86	2.46	1.62	[illegible]	[illegible]
11	------	.38	2.16	2.66	[illegible]	[illegible]	[illegible]
12	------	.16	2.06	2.56	[illegible]	1.88	[illegible]
13	------	.86	[illegible]	2.46	1.46	1.86	[illegible]
14	------	.16	[illegible]	2.46	1.52	1.86	[illegible]
15	------	.16	[illegible]	2.51	1.46	1.71	1.38
16	------	.86	[illegible]	2.46	1.46	1.78	1.38
17	------	[illegible]	[illegible]	2.56	1.46	1.58	1.38
18	------	.01	2.66	2.38	1.46	1.71	[illegible]
19	------	—.04	2.38	2.61	1.38	1.86	[illegible]
20	------	.11	2.56	2.21	1.31	2.16	1.53
21	------	.36	2.71	2.36	1.41	2.01	1.38
22	------	.46	2.66	2.16	1.46	2.88	[illegible]
23	—.04	.46	2.56	2.16	1.38	1.81	[illegible]
24	—.04	.46	2.56	2.11	1.38	1.81	[illegible]
25	—.04	.36	2.81	2.16	1.38	[illegible]	[illegible]
26	.11	.78	3.01	2.06	1.31	2.76	[illegible]
27	.21	2.31	2.86	2.21	1.41	[illegible]	1.78
28	.01	2.26	2.78	1.78	1.61	3.36	1.36
29	—.04	1.78	2.41	1.78	------	2.31	.91
30	—.09	1.16	2.61	1.71	------	1.41	.78
31	.01	------	2.36	1.71	------	1.06	------

* Minus sign indicates backwater from dam below.

Fall of Mohawk River from Rexford Flats, Gauge No. 5, to Vischer's Ferry, Gauge No. 4.

DAY.	1900.			1901.			
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	------	29.44	28.86	27.30	28.14	28.74	30.02
2	------	29.50	28.70	27.00	28.24	28.70	30.00
3	------	29.40	29.14	28.70	28.44	28.80	30.32
4	------	29.40	29.00	27.04	28.30	28.70	27.35
5	------	29.64	27.90	27.30	28.30	28.84	28.81
6	------	29.00	27.74	27.30	28.30	28.00	28.84
7	------	29.70	28.20	27.20	28.44	28.80	30.10
8	------	29.80	28.30	27.11	28.30	28.80	28.90
9	------	30.04	28.80	28.86	28.80	28.00	30.28
10	------	29.30	------	27.19	28.44	28.00	31.88
11	------	29.40	------	28.94	28.04	28.19	32.46
12	------	29.64	------	28.30	28.30	27.90	33.80
13	------	29.74	------	27.04	28.54	27.80	34.63
14	------	29.00	------	26.90	28.50	28.04	27.50
15	------	29.00	------	27.00	28.00	27.90	27.33
16	------	29.70	------	27.00	28.50	27.94	27.24
17	------	29.80	------	27.24	28.64	28.04	27.24
18	------	29.80	------	27.44	28.50	27.94	27.30
19	------	30.04	------	27.34	28.00	27.74	27.67
20	------	29.94	------	27.20	28.70	27.40	27.22
21	------	29.44	------	27.74	28.54	27.44	27.67
22	------	29.04	------	27.94	28.50	28.00	28.14
23	29.90	29.14	------	27.70	28.00	27.14	29.07
24	29.90	29.14	26.90	27.50	28.00	28.94	29.73
25	29.94	29.30	26.80	27.50	28.50	27.04	29.05
26	29.94	28.94	25.80	27.74	28.54	27.00	28.10
27	29.60	27.74	25.94	28.30	28.54	------	28.70
28	29.70	27.20	26.14	28.74	28.90	27.36	29.16
29	29.64	27.24	26.09	28.64	------	27.40	29.54
30	26.50	27.90	26.74	28.24	------	28.12	29.70
31	29.44	------	27.19	28.19	------	29.00	------

*Fall of Mohawk River from Schenectady, Gauge No. 8, to Rexford Flats, Gauge No. 6.**

DAY.	1900. Oct.	1900. Nov.	1900. Dec.	1901. Jan.	1901. Feb.	1901. Mar.	1901. Apr.
1	.09	.02	.66	.21	.41	.11	.86
2	.18	.16	.56	.31	.26	.06	.56
3	.17	.05	.86	.01	.26	.01	.56
4	.22	—.08	.26	.01	.21	.01	1.41
5	.17	.0	1.71	.41	.31	.06	.51
6	.17	—.08	1.11	.21	.21	.11	1.46
7	.01	—.10	.76	.16	.21	.26	1.51
8	.07	—.07	.76	.41	.01	.21	3.16
9	.16	.25	.66	.16	.01	.16	1.96
10	.07	.39	......	.16	.21	.11	1.71
11	.07	.41	......	.36	.11	.45	1.36
12	.11	.11	......	.41	.21	.56	1.01
13	.04	.06	......	.69	.16	.86	1.11
14	.14	.11	......	.43	.11	.61	1.11
15	—.05	.26	......	.26	.06	.46	1.16
16	—.02	.11	......	.08	—.04	.61	1.21
17	.0	.06	......	.01	.06	.61	1.11
18	.0	.06	......	.06	—.14	.51	1.08
19	.31	.11	......	.10	—.14	.61	1.21
20	.24	.61	......	.01	—.04	.81	1.01
21	.0	.21	......	.51	—.04	1.04	1.01
22	.0	.56	......	—.04	.06	2.76	4.06
23	—.07	.51	......	—.04	—.11	2.41	2.66
24	.0	.46	—.09	.16	.06	1.51	2.41
25	.08	.21	.26	.11	.06	1.41	2.44
26	.12	.94	1.41	.16	.16	2.13	2.06
27	—.03	2.01	1.06	—.54	.06	2.39	1.41
28	—.20	1.91	.69	.18	.11	3.06	1.11
29	—.21	1.66	.41	.56	......	2.26	.76
30	—.03	.91	.36	.11	......	1.51	.71
31	.04	......	.26	.46	......	.96	......

* Minus sign indicates backwater from dam below.

Fall of Mohawk River from Gauge No. 9, Hoffman's Ferry to Gauge No. 8, Schenectady.

DAY.	1900. Oct.	1900. Nov.	1900. Dec.	1901. Jan.	1901. Feb.	1901. Mar.	1901. Apr.
1	......	26.00	27.80	27.05	26.10	26.15	27.85*
2	......	26.10	27.55	26.70	26.20	26.05	27.55*
3	......	26.07	27.50	26.60	26.25	26.15	28.45*
4	......	25.80	27.45	26.35	26.20	26.20	28.30*
5	......	25.75	29.10	25.90	26.10	26.30	28.90*
6	......	25 63	28.05	26.60	26.50	26.85	28.75*
7	......	25.70	28.15	26.55	26.60	26.80	29.55*
8	......	25.87	28.10	26.35	26.80	26.55	28.10*
9	......	27 90	28.90	26.60	26.75	26.40	28.70*
10	......	27.80	27.80	26.65	26.75	26.90	28.35*
11	......	26.80	27.00	27.35	26.95	27.60	28.34*
12	......	26.55	27.25	27.25	26.45	28.05	28.50*
13	......	26.45	26.85	26.77	26.75	27.65	28.30*
14	......	26.35	26.70	27.08	27.30	27.50	28.50*
15	......	26.35	27.80	26.90	27.00	27.55	28.55*
16	......	26.25	28.80	26.83	27.20	28.00	28.45*
17	......	25.95	28.60	26.75	26.46	28.15	28.80*
18	......	26.05	28.30	26.55	26.25	27.70	28.33*
19	......	26.05	28.30	26.56	26.85	28.75*	28.85*
20	......	26.90	28.40	26.80	26.25	28.75*	28.30*
21	......	28.35	28.40	26.10	26.25	28.92*	29.55*
22	......	27.75	28.10	26.45	26.20	29.00*	28.33*
23	......	27.65	27.85	27.35	26.25	27.05*	29.40*
24	25.40	27.25	27.60	26.90	26.25	28.30*	28.65*
25	26.22	27.05*	30.25	26.75	26.35	28.30*	29.52*
26	26.75	29.32*	28.15	26.45	26.00	29.13*	27.60*
27	26.30	29.25*	28.00	26.30	26.35	29.42*	28.40*
28	26.05	28.85*	27.57	25.58	26.30	28.45*	27.85*
29	26.15	28 00*	27.30	25.75	......	28.30*	28.00*
30	26.15	27.95*	27.25	26.55	......	28.05*	27.90*
31	26.05	......	27.00	26.25	......	28.10*	......

* Due to sudden freshet.

Fall of Mohawk River from Gauge No. 16, Amsterdam, to Hoffman's Ferry, Gauge No. 9.

DAY.	1900.			1901.			
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	------	12.84	11.94	13.14	14.54	14.24	12.84
2	------	13.34	12.00	13.30	14.64	14.04	12.24
3	------	13.34	12.19	15.04	14.30	14.30	12.34
4	------	13.29	12.23	15.64	14.50	14.40	12.34
5	------	[illegible]	11.30	15.44	14.04	14.30	11.39
6	------	13.64	11.54	15.19	14.30	13.90	11.44
7	------	13.64	11.74	15.19	14.14	13.80	11.30
8	------	13.50	11.74	15.14	14.19	14.00	11.24
9	------	12.30	12.94	15.00	14.04	14.44	11.39
10	------	12.29	12.30	15.19	14.00	13.94	11.30
11	------	12.74	12.74	14.74	13.80	13.74	11.30
12	------	12.80	12.80	14.44	14.24	13.54	11.40
13	------	13.14	12.04	14.04	13.94	13.34	11.30
14	------	13.24	12.50	14.30	13.40	13.79	11.40
15	------	13.24	12.00	14.30	13.04	13.00	11.46
16	------	13.34	11.29	14.40	13.54	13.44	11.44
17	------	13.54	12.04	14.44	14.14	13.29	11.50
18	------	13.50	13.84	14.64	14.39	13.84	11.50
19	------	13.50	13.90	14.40	14.29	13.54	11.40
20	------	13.19	13.79	14.20	14.40	13.00	11.50
21	------	12.00	13.54	14.19	14.30	13.74	12.40
22	------	12.00	13.74	14.54	14.34	15.54	16.44
23	------	12.14	13.84	14.30	14.44	15.29	11.64
24	13.80	12.34	13.80	14.40	14.29	12.04	11.19
25	13.79	12.59	12.00	14.30	14.24	11.94	10.19
26	12.80	11.00	12.80	15.24	14.44	10.94	10.90
27	13.00	11.64	12.90	14.94	14.29	11.54	11.39
28	13.34	11.29	13.29	14.44	14.24	12.14	------
29	13.29	11.44	13.54	14.64	------	11.19	------
30	12.79	11.84	13.49	14.40	------	11.29	------
31	13.34	------	13.34	14.40	------	11.79	------

Fall of Mohawk River from Fort Hunter, Gauge No 13, to Amsterdam, Gauge No. 16.

DAY.	1900.			1901.			
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	------	19.71	18.56	18.91	19.01	19.06	18.71
2	------	19.01	18.81	18.96	19.06	19.56	18.86
3	------	18.96	18.81	17.76	19.11	19.56	18.61
4	------	19.31	19.51	17.06	19.21	19.36	18.36
5	------	19.21	18.46	18.01	19.26	19.26	18.16
6	------	19.11	18.26	18.01	19.21	19.06	18.16
7	------	19.11	18.56	18.11	19.31	19.16	17.41
8	------	19.06	18.66	18.21	19.11	19.26	17.06
9	------	19.06	18.86	18.11	------	19.11	17.96
10	------	18.46	18.71	17.81	19.11	19.01	18.21
11	------	18.81	19.06	17.21	19.21	18.26	19.06
12	------	18.96	19.01	17.51	19.21	19.01	19.01
13	------	18.96	19.36	17.51	19.26	19.06	18.97
14	------	18.91	19.26	17.81	19.21	19.01	18.81
15	------	18.96	19.31	18.11	19.31	18.96	18.71
16	------	18.91	19.31	18.26	19.31	18.81	18.71
17	------	18.91	18.86	18.31	19.36	19.01	18.81
18	------	18.91	17.21	18.11	19.21	18.36	18.86
19	------	18.76	17.11	18.31	19.21	17.96	18.86
20	------	18.26	17.11	18.51	19.26	17.41	19.01
21	------	16.86	17.21	18.91	19.31	17.76	17.36
22	------	18.76	17.26	18.66	19.41	12.41	15.56
23	------	19.01	17.51	17.96	19.36	14.61	16.61
24	------	19.16	17.71	18.01	19.41	17.06	17.71
25	19.16	21.86	17.00	18.36	19.51	17.76	17.46
26	18.91	20.46	17.41	17.91	19.61	17.06	17.06
27	18.96	16.81	17.81	18.41	19.51	16.46	18.71
28	19.01	16.91	17.76	18.91	19.51	16.51	------
29	19.01	17.31	17.96	18.81	------	17.86	------
30	19.46	18.06	18.26	18.91	------	19.46	------
31	19.06	------	18.81	18.96	------	18.06	------

Fall of Mohawk River from Yosts, Gauge No. 14, to Fort Hunter, Gauge No. 8.

DAY.	1900.			1901.			
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	......	8.53	10.08	9.03	8.13	7.98	10.18
2	......	8.68	9.48	8.68	8.08	8.03	9.53
3	......	8.63	9.28	8.38	8.03	8.18	10.53
4	......	8.43	8.48	7.98	8.03	8.18	11.28
5	......	8.28	10.58	7.98	8.03	8.28	11.18
6	......	8.33	10.38	7.98	8.08	8.53	10.38
7	......	8.43	10.13	8.03	8.23	8.33	10.08
8	......	8.78	10.08	8.13	8.43	8.08	10.93
9	......	9.93	9.93	8.33	......	8.28	11.53
10	......	9.48	9.28	9.58	8.33	9.08	11.18
11	......	9.03	8.48	9.73	8.28	9.33	10.33
12	......	8.73	9.88	9.78	8.13	8.58	10.08
13	......	8.63	9.53	9.63	8.38	8.68	10.02
14	......	8.58	9.98	9.38	8.33	8.63	10.38
15	......	8.43	9.23	9.23	8.33	8.63	10.78
16	......	8.38	8.98	9.03	8.28	8.98	10.88
17	......	8.38	8.98	9.18	8.18	8.83	10.48
18	......	8.33	9.08	9.53	8.18	9.13	10.68
19	......	8.68	8.98	9.28	8.18	10.38	10.68
20	......	10.08	9.33	8.78	8.28	9.88	10.88
21	......	12.28	9.38	8.43	8.20	10.48	9.48
22	......	10.08	9.28	8.73	8.13	12.73	9.88
23	......	9.63	9.08	9.28	8.23	13.58	......
24	......	9.23	9.13	9.28	8.13	13.63	11.68
25	......	6.18	10.53	8.98	8.08	13.78	10.03
26	......	10.63	10.88	8.78	8.03	14.08	9.53
27	......	13.53	10.28	8.53	8.13	14.43	9.23
28	......	14.23	9.98	8.38	8.13	13.88	......
29	8.83	12.38	9.58	8.28	......	12.33	......
30	8.63	11.28	9.13	8.13	......	10.53	......
31	8.58	......	8.93	8.18	......	10.48	......

Fall of Mohawk River from Canajoharie, Gauge No. 15, to Yosts, Gauge No. 14.

DAY.	1900.			1901.			
	Oct.	Nov.	Dec.	Jan.	Feb	Mar.	Apr.
1	......	9.79	8.14	9.59	8.69	8.54	8.89
2	......	9.84	9.59	9.19	8.69	8.59	10.14
3	......	9.89	8.44	8.69	8.69	8.49	9.14
4	......	9.64	8.94	9.19	8.64	8.54	8.49
5	......	9.44	7.84	8.89	8.59	8.59	8.39
6	......	9.49	8.84	8.74	8.59	8.44	8.39
7	......	8.78	8.99	8.69	8.39	8.54	8.31
8	......	8.35	8.69	8.99	8.09	8.69	8.09
9	......	9.99	8.59	8.39	8.04	8.59	8.34
10	......	9.04	9.54	9.19	8.19	8.59	8.44
11	......	9.94	10.74	9.39	8.24	8.69	8.39
12	......	9.24	9.84	8.69	8.39	8.39	8.44
13	......	9.44	12.14	9.09	8.19	8.44	8.69
14	......	9.64	11.24	8.69	8.19	8.69	8.84
15	......	9.69	10.29	8.79	8.19	8.74	8.94
16	......	9.24	11.19	8.49	8.24	10.44	8.79
17	......	9.84	11.14	7.89	8.49	10.29	8.69
18	......	9.56	9.59	7.27	8.59	8.59	8.99
19	......	9.69	9.14	7.57	8.69	7.74	8.84
20	......	8.89	9.79	8.29	8.59	7.64	8.69
21	......	7.97	9.54	8.74	8.59	8.69	8.74
22	......	7.74	9.84	9.09	8.69	7.64	7.49
23	......	8.94	9.79	8.44	8.59	7.89	......
24	......	9.19	9.79	8.14	8.64	7.44	8.09
25	......	9.24	9.49	8.54	8.44	7.44	7.89
26	......	8.99	9.99	8.34	8.64	5.69	8.69
27	......	8.04	9.59	8.59	8.59	6.94	8.99
28	......	8.09	9.64	8.74	8.44	7.79	......
29	9.19	8.64	9.84	8.59	......	8.09	......
30	9.24	8.39	9.59	8.69	......	8.69	......
31	9.99	......	9.74	8.69	......	8.89	......

Fall of Mohawk River from Gauge No. 16, St. Johnsville, to Gauge No. 15, Canajoharie.

DAY.	1900.			1901.			
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	....	12.00	13.00	12.30	13.00	....	12.74
2	....	13.00	12.49	12.84	13.80	....	11.80
3	....	12.94	13.64	13.30	13.84	13.50	12.44
4	....	12.74	13.30	13.00	13.84	13.50	12.44
5	....	12.90	13.84	13.54	13.90	13.34	13.14
6	....	12.90	13.29	13.74	14.19	13.24	13.00
7	....	13.75	12.80	13.49	14.29	13.34	12.47
8	....	15.08	13.24	13.34	14.30	13.44	12.40
9	....	12.94	12.84	13.00	14.19	13.49	12.94
10	....	13.79	12.44	12.90	14.00	12.94	12.40
11	....	12.30	11.44	12.00	14.00	13.74	12.44
12	....	13.09	11.24	13.24	13.90	12.49	12.74
13	....	12.90	9.19	12.00	13.90	12.64	12.79
14	....	12.80	9.29	13.19	13.90	12.64	....
15	....	13.04	12.80	12.90	13.90	12.64	....
16	....	13.24	11.94	13.30	13.90	12.64	....
17	....	13.14	11.79	14.01	13.74	10.00	....
18	....	12.92	12.94	14.06	13.74	12.44	....
19	....	13.64	13.64	14.31	13.00	13.00	....
20	....	14.90	12.84	13.80	13.74	12.94	....
21	....	15.19	12.99	13.00	13.00	12.24	....
22	....	15.00	12.00	13.64	13.00	12.00	....
23	....	13.79	12.29	13.74	13.49	13.94	....
24	....	13.00	13.00	13.84	....	15.30	....
25	....	13.74	13.54	13.49	....	15.14	....
26	....	14.24	11.80	13.79	....	14.90	....
27	....	13 54	12.14	13.00	....	13.94	....
28	13.19	13.14	12.04	13.60	....	13.14	....
29	13.24	12.24	12.30	13.84	....	12.79	....
30	13.00	12.84	12.60	13 80	....	12.50	....
31	12.34	....	12.30	13.79	....	12.50	....

Fall of Mohawk River from Rocky Rift Dam, Gauge No. 17, to St Johnsville, Gauge No. 16.

DAY.	1900.			1901.			
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	....	17.73	17.49	....	16.78	....	16.93
2	....	17.81	17.48	....	16.68	....	17.38
3	....	17.78	17.58	....	16.68	17.08	16.83
4	....	17.88	17.43	....	16.73	16.98	17.13
5	....	17.91	16.73	....	16.73	16.98	16.98
6	....	17.98	17.58	....	16.68	17.08	16.78
7	....	17.86	18.33	....	16.68	17.18	16.73
8	....	18.35	17.83	17.48	16.68	17.48	16.73
9	....	17.38	17.78	16.68	16.88	17.33	17.73
10	....	16.98	17.98	16.98	16.88	17.33	17.58
11	....	17.66	17.93	17.08	16.83	17.18	17.38
12	....	17.73	17.73	17.08	16.93	17.08	17.23
13	....	17.83	17.48	17.18	17.08	16.73	17.13
14	....	17.76	17.78	17.08	17.33	16.68	....
15	....	17.63	15.71	17.08	17.18	17.08	....
16	....	17.98	15.98	17.08	16.98	16.73	....
17	....	17.93	16.16	16.98	16.93	16.73	....
18	....	17.98	16.51	16.08	16.83	17.28	....
19	....	17.23	16.43	16.73	16.83	16.88	....
20	....	16.98	16.53	16.98	16.68	17.78	....
21	....	16.76	16.58	16.58	16.68	17.38	....
22	....	16.28	17.18	16.13	16.68	16.68	....
23	....	16.96	17.28	16.68	16.78	15.08	....
24	....	17.48	17.43	16.58	....	13.38	....
25	....	18.23	16.63	16.43	....	13.43	....
26	....	16.42	16.68	17.08	....	14.78	....
27	....	17.03	17.03	16.78	....	14.08	....
28	17.66	17.03	17.48	16.68	....	14.58	....
29	17.76	18.23	17.23	16.68	....	16.58	....
30	17.78	17.43	16.98	16.68	....	17.18	....
31	18.08	....	17.31	16.73	....	17.18	....

*Fall of Mohawk River from Surface of Tailrace, Little Falls Paper Co.'s Mill, Little Falls, N. Y., to Water Surface Above Rocky Rift Dam.**

DAY.	1900.			1901.			
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	......	.44	.90	......	.80	2.82	1.55
2	......	.42	1.22	......	.80	2.82	.79
3	......	.54	.57	......	.80	2.42	.80
4	......	.59	.64	......	.80	2.52	.97
5	......	.64	1.92	......	.72	2 52	1.57
6	......	.67	1.82	......	.72	2.52	2.67
7	......	.57	1.15	......	.72	2.42	2.64
8	......	—.11	1.04	.07	.72	2.80	2.70
9	......	.69	1.42	—.06	.72	2.89	3.27
10	......	1.12	.44	—.16	.77	2.29	3.07
11	......	.75	.42	—.21	.74	2.14	2.99
12	......	.95	.32	—.08	.84	2.14	1.22
13	......	.40	.37	.34	.79	1.72	1.50
14	......	.42	.30	.49	.64	1.55	1.05
15	......	.47	.37	.80	.64	1.50	1.04
16	......	.22	.45	.92	.77	1.45	1.29
17	......	.34	.37	.60	.79	1.50	1.14
18	......	.32	.40	.64	.84	1.20	1.52
19	......	.40	.32	.84	.79	.55	1.85
20	......	.50	.37	.67	.94	1.05	1.70
21	......	1.24	.34	.52	1.87	.37	2.27
22	......	1.42	.47	.49	1.92	2.59	1.97
23	......	1.39	.42	.39	2.22	3.52	4.60
24	......	.85	.49	.69	2.22	3.62	1.45
25	......	2.22	.52	.64	2.22	3.57	2.39
26	......	2.80	.42	.65	2.22	4.22	2.25
27	......	3.97	.62	.75	2.22	5.17	2.24
28	.62	3.77	.02	.80	2.22	6.47	2.39
29	.49	3.47	.94	.80	......	6.97	2.17
30	.59	4.89	.91	.55	......	5.89	1.89
31	.52	......	.89	.50	......	1.47	......

* Minus sign indicates backwater from dam at foot of section.

Fall of Mohawk River from Herkimer, Gauge No. 24, to Little Falls, Gauge No. 23, Above Gilbert's Dam.

DAY.	1900.			1901.			
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	......	11.70	15.20	......	13.80	18.80	13.10
2	......	11.45	12.50	......	14.60	17.70	13.85
3	......	10.95	13.00	......	14.40	17.10	14.65
4	......	......	13.55	......	13.80	16.60	14.35
5	......	......	13.10	......	13.60	15.70	14.80
6	......	12.00	14.00	......	13.40	15.80	15.10
7	......	12.55	13.85	......	13.80	14.80	15.25
8	......	12.80	12.75	13.70	14.40	14.80	15.15
9	......	13.00	12.50	13.35	17.70	19.70	14.70
10	......	12.60	12.80	13.25	14.40	13.10	14.55
11	......	12.25	13.10	13.70	14.45	14.20	14.96
12	......	11.95	12.90	14.20	14.20	14.15	14.65
13	......	11.50	13.50	13.60	14.10	14.10	14.15
14	......	11.40	13.65	13.70	13.35	13.20	13.55
15	......	11.25	13.85	13.40	13.10	12.70	13.20
16	......	11.75	13.55	13.65	12.65	13.20	13.00
17	......	11.85	13.85	14.20	13.10	13.75	13.00
18	......	11.75	13.85	13.95	13.10	14.30	12.75
19	......	11.95	14.95	14.30	13.20	14.90	12 80
20	......	11.75	15.20	14.45	13.45	16.65	13.00
21	......	11.65	15.05	14.85	13.40	17.30	......
22	......	12.95	14.90	14.65	13.35	15.10	......
23	......	13.55	14.50	13.50	13.00	14.10	......
24	......	14.00	13.95	12.70	12.90	14.50	......
25	......	14.35	14.85	12.50	12.70	15.25	......
26	......	15.15	13.90	13.20	12.70	15.75	......
27	......	15.85	13.85	13.45	19.80	15.60	......
28	11.40	15.65	14.10	13.50	18.80	15.60	......
29	11.20	16.00	13.60	14.10	......	15.70	......
30	11.00	15.25	......	14.45	......	16.35	......
31	11.05	......	......	14.30	......	12.85	......

In order to reduce the observed gauge readings and obtain the corresponding rates of discharge, the method outlined below was pursued.

From the well known Chezy formula,

$$Q = A V \quad \text{.........................} \quad (1)$$

$$V = C\sqrt{RS} \quad \text{.........................} \quad (2)$$

$$R = \frac{A}{P} \quad \text{.........................} \quad (3)$$

Q = discharge of stream in second-feet.

A = area of cross section, square feet.

V = mean velocity of flow in feet per second.

S = the sine of the surface slope, for which owing to its small value the surface slope has been substituted.

R = hydraulic radius or hydraulic mean depth of the channel.

P = wetted perimeter or circumference of the stream cross section exposed to friction.

C is a variable coefficient.

The lengths of the reaches of the stream covered by the several slope sections are shown in the accompanying table. Using the known elevations of the gauge zeros, a series of tables of mean daily fall from gauge to gauge have been prepared by means of the formula:

Fall = difference of elevation of gauge zeros + reading of upper gauge − reading of lower gauge.......................... (4)

These tables show at once the great variations in the rate of fall under varying stages, or when affected by wind, ice, backwater or sudden rising or falling of the stream.

Data was then computed for each section from which a diagram could be prepared showing the value of $\sqrt{S}$ from the formula:

$$S = \frac{F}{L} \quad \text{.........................} \quad (5)$$

F = fall in feet.

L = constant length of the slope section, feet.

These curves have a range equal to the observed range of variation in fall and from them a second series of tables showing the value of $\sqrt{S}$ for each day were made out.

To determine the area of cross section, wetted perimeter and hydraulic radius, the topographic maps of Mohawk River prepared by the U. S. Board of Engineers on Deep Waterways were available. These maps show cross sections of the stream channel taken at an average interval of 300 feet from Hudson River to Rome. In making the cross sections, soundings were taken at average intervals of 25 feet across the channel. The elevations of the stream bed so determined have been reduced to the datum to which the positions of the slope gauges are referred.[a]

To utilize the information at hand in such a manner as to attain the true mean cross section for each slope section, the average elevation of the stream bed below low-water mark was determined. In doing this every alternate cross section, or in critical locations, every section, was copied from the maps and the average of the soundings taken. In this way the elevations of a series of assumed horizontal cross sections at a large number of points in each slope section were obtained. The average of these has been used as the mean elevation of the stream bed for each slope section. In a similar manner the average width of the stream bed below low-water mark was determined from the cross sections for each slope section.

A third series of tables were prepared from the gauge readings showing the average of the elevations of the water surface at the upper and lower ends of each slope section for each day. This was taken as the elevation of the mean water surface above the mean stream bed previously determined.

The side slopes of the channel above the low-water mark were found to have an average inclination of very nearly 1:1. A series of curves were prepared, one for each slope section, showing the area of cross section corresponding to any mean

a The methods of cross sectioning the channel and of taking the Mohawk river soundings are described in a paper by D. J. Howell, C. E., Engineering News, June 21 and June 28, 1900, pp. 418-422.

elevation of water surface as given in the tables. The formula for area of cross section is as follows:

$$A=(W-D)D \qquad (6)$$

W=width of stream bed, feet.

D=difference of elevation of stream bed and mean water surface, feet.

A series of values of the wetted perimeter of the cross section were then found by the formula

$$P=W-2\sqrt{2}D+\frac{1}{2}(W-2D) \qquad (7)$$

The fraction $\frac{1}{2}(W-2D)$, represents one-half of the area of the exposed water surface, which was added to the perimeter in earth to allow for the effect of wind and air friction in open weather, and of friction on the ice coating when the stream surface was frozen. The proper value for this quantity is quite uncertain, as the extent to which the stream was frozen-over varied greatly at different times. From the gauge readers' reports it was found that there were marginal strips of ice along both banks during several months of the winter season, the width of the strips increasing so as to cover the entire surface on mill-ponds or elsewhere that the current was sluggish, and diminishing in extent over rifts or through narrows. The fraction $\frac{1}{2}$ was selected as best representing the average condition during the entire period while the gaugings were being kept. Finally a diagram was prepared for each slope-section showing values of R for any elevation of the mean water surface.

The value of the coefficient C varies with the slope and hydraulic radius. It is also a function of the general character of the stream channel, including the roughness of the material composing the stream bed, the frequency of bends, their abruptness, the occurrence of islands or sudden changes in cross section, the presence of aquatic plants, etc. These factors are all summed up in terms of the "degree of roughness," of the channel, usually expressed by the letter n. This has been assigned the value of 0.0325. The stream during high water being considered as having fairly good regimen when expressed

in terms of the usual hydraulic scale, so that $n=.030$ would apply to the better slope sections, which only have been computed. When obstructed with ice or during low water $n=.035$ could properly be used. For the sake of uniformity the mean of the two values has been adopted. To determine C the diagram of Hering and Trautwine was used.[a]

Having given the fall and the elevation of the mean water surface for each day, it was only necessary to take from the diagrams the values of the factors A, C, $\sqrt{R}$, and S, which, when multiplied together, give the rate of discharge. The labor of this multiplication was greatly lessened by the use of Crelle's tables.[b]

The discharge has been calculated only for those slope sections considered to possess the most perfect regimens. Owing to variations in the area of cross section, irregularities in the stream channel, etc., the surface slope is much more nearly uniform for high water than for lower stages, and the results of the calculations are proportionately more reliable. As noted above, gauge readings in winter were taken to the surface of water rising in a hole through the ice. It has not been found practicable to correct the stream cross sections by deducting the thickness of ice below water surface as should properly be done.

DISCHARGE FROM SLOPE GAUGINGS.

In the final computations it was found to be impracticable to calculate the flow of Mohawk River for each day, or in fact for any but extreme high water stages from the slope gaugings. The presence of slack water in bays and eddies and of rifts and sudden changes of slope during low or moderate stages make the apparent cross-section and surface slope much greater than the effective grade and section. With the increased cross-section and velocity due to high water these sources of error largely disappear, and the results of the calculations may in general be relied upon as being fairly accurate.

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a Flow of water, etc., Ganguillet and Kutter, translated by Rudolph Hering and John C. Trautwine.

b Rechentafeln, by A. L. Crelle, containing the products of all factors from 1 to 1,000.

The slope gaugings were originally established by the Barge Canal Survey in 1900 for the purpose of determining the freshet discharge of the Lower Mohawk.

The calculated discharge during several high water periods is given below and is of interest in reference to the effect of floods on barge canals. The tables of mean daily elevation of water surface and fall of Mohawk River from gauge to gauge are also useful in showing the development and progress of floods.

High Water Discharge of Mohawk River; Estimated from Gauging of Surface Slope. St. Johnsville—Canajoharie Section.

[Mean drainage area, 1,775 square miles.]

FLOOD OF NOVEMBER 27, 1900.

1900.	Estimated Discharge.	
	Second-feet.	Second-feet per square mile.
November 25	4,500	2.5
November 26	15,480	8.7
November 27	17,320	9.7
November 28	16,100	9.1
November 29	9,280	5.2
November 30	6,970	3.9

FLOOD OF MARCH 27, 1901.

1901.	Estimated Discharge.	
	Second-feet.	Second-feet per square mile.
March 25	15,842	8.9
March 26	15,576	8.8
March 27	21,376	12.0
March 28	19,442	10.9
March 29	12,628	7.1

FLOOD OF APRIL 8, 1901.

1901.	Estimated Discharge	
	Second-feet.	Second-feet per square mile.
April 8	12,312	6.9
April 9	11,745	6.6
April 10	10,419	5.9

High Water Discharge of Mohawk River; Estimated from Gauging of Surface Slope.

Canajoharie—Yost's Section.

[Mean drainage area, 1,933 square miles.]

FLOOD OF NOVEMBER 27, 1900.

1900.	Estimated Discharge.	
	Second-feet.	Second-feet per square mile.
November 27	18,271	9.4
November 28	18,088	9.3
November 29	12,948	6.7

FLOOD OF MARCH 27, 1901.

1901.	Estimated Discharge.	
	Second-feet.	Second-feet per square mile.
March 24	15,038	7.8
March 25	15,184	7.9
March 26	14,364	7.4
March 27	25,860	13.4
March 28	27,110	14.0
March 29	15,504	8.0

FLOOD OF APRIL 8, 1901.

1901.	Estimated Discharge.	
	Second-feet.	Second-feet per square mile.
April 6	12,865	6.7
April 7	14,553	7.5
April 8	16,656	8.6
April 9	15,554	8.0
April 10	13,795	7.1

High Water Discharge of Mohawk River; Estimated from Gaugings of Surface Slope.
Fort Hunter—Amsterdam Section.

[Mean drainage area, 3,145 square miles.]

FLOOD OF NOVEMBER 27, 1900.

1900.	Estimated Discharge.	
	Second-feet.	Second-feet per square mile.
November 26	14,580	4.6
November 27	17,763.5	5.6
November 28	14,022	4.5
November 29	8,341	2.7

FLOOD OF MARCH 27, 1901.

1901.	Estimated Discharge.	
	Second-feet.	Second-feet per square mile.
March 24	12,597	4.0
March 25	11,400	3.6
March 26	17,600	5.6
March 27	25,515	8.1
March 28	23,206	7.4
March 29	14,420	4.6

FLOOD OF APRIL 8, 1901.

1901.	Estimated Discharge.	
	Second-feet.	Second-feet per square mile.
April 6	14,586	4.6
April 7	19,000	6.0
April 8	21,625	6.9
April 9	16,385	5.2
April 10	13,132	4.2

FLOOD OF APRIL 22, 1901.

1901.	Estimated Discharge.	
	Second-feet.	Second-feet per square mile.
April 20	8,610	2.7
April 21	13,696	4.4
April 22	32,276	10.3
April 23	28 000	8.9
April 24	19,404	6.2
April 25	24,075	7.7
April 26	17,068	5.4

High Water Discharge of Mohawk River Estimated from Gaugings of Surface Slope.
Rexford Flats—Vischer's Ferry Section.
[Mean drainage area, 3,396 square miles.]

FLOOD OF NOVEMBER 27, 1900.

1900.	Estimated Discharge.	
	Second-feet.	Second feet per square mile.
November 26	14,787	4.3
November 27	30,176	8.9
November 28	27,018	8.1

FLOOD OF MARCH 27, 1901.

1901.	Estimated Discharge.	
	Second-feet.	Second-feet per square mile.
March 25	20,041	5.9
March 26	31,800	9.3
March 27	....	....
March 28	37,288	11.0
March 29	27,650	8.1

FLOOD OF APRIL 9, 1901.

1901.	Estimated Discharge.	
	Second-feet.	Second-feet per square mile.
April 7	30,079	9 0
April 8	37,366	11.0
April 9	37,848	11.1
April 10	38,533	11.3

FLOOD OF APRIL 22, 1901.

1901.	Estimated Discharge.	
	Second-feet.	Second-feet per square mile.
April 21	17,955	5 2
April 22	60,990	17.93
April 23	45,966	13.4
April 24	41,250	12.1

UPPER HUDSON RIVER DRAINAGE.

INDIAN RIVER AT INDIAN LAKE DAM, HAMILTON COUNTY, N. Y.

Indian River, a tributary of the Upper Hudson, contains a precipitous forested mountain area of 146 square miles, in eastern Hamilton county. In 1898 a masonry storage dam was built at the foot of Indian Lake, replacing the lumberman's dam which was formerly there, and raising the level of the artificial lake so formed 23 feet. The storage capacity of the present lake is 5,000,000,000 cubic feet. The area of the water surface of the lake is 5,035 acres, and the elevation of the spillway crest above mean tide is 1,650 feet. The dam was built by a federation of water-power users on the Hudson River, in co-operation with the State of New York, the primary object being to store flood water from this drainage area to be turned into the Hudson during the low water period of each year, thereby equalizing the flow to some extent. Water is also used for sluicing logs during the river driving season.[a]

Since July 22, 1900, a gauging record has been kept at the dam, with a view to determining the total outgo from this reservoir; the facts recorded being the elevation of the water surface in the reservoir, depth of water flowing over the spillway or flashboards, width of opening and head on the main and subsidiary logways, and the width of opening of each of the five-foot sluice gates, together with the effective head on the openings. These facts will enable a calculation of the outflow from the reservoir to be made, and, by comparison with gauging records kept on Hudson River at Fort Edward and Mechanicville, the effect of storage on the low water flow of the Hudson can be determined.

A meteorological station has been established at the dam by the United States Weather Bureau, including rainfall, temperature and other records. The regimen of flow of Indian River below the dam is largely artificial, though in the course of a year or more the total annual run-off of the drainage area will appear in the stream, and it is hoped in the course of time to determine

a See Engineering News, May 18, 1899.

the relation between the rainfall and run-off of what constitutes rather a typical Adirondack Watershed.

When the reservoir is full, the excess of inflow passes over the spillway, which has a level crest 106.05 feet long in the clear. To facilitate the calculation of discharge over this spillway, a series of experiments were made at Cornell University, June 6, 1899, on a full-sized model of the spillway section, 6.58 feet long, from which the proper coefficients of discharge have been determined.[a]

The discharge through the two 5-foot sluice gates, provided as a means for drawing the water down as required, is calculated from the observed head and from the area of the lune-shaped gate orifices by the ordinary formula. The value of the coefficients of discharge to be applied may be checked by current meter measurements made at a convenient bridge below the dam. The results of these calculations will be somewhat uncertain until the reservoir is cleared of drift which tends to obstruct the gate openings during low water.

A measurement of the flow at this point on October 19, 1900, showed the rate of draught from the reservoir to be 541 second-feet, both sluice-gates being full opened under an effective head of 6.25 feet, but apparently somewhat clogged by drift. Until additional measurements can be made under more favorable conditions, the flow through the sluice-gates will be calculated by means of the formula for orifices, using the ordinary coefficient 0.62.

A measurement of the Hudson River at Mechanicville, made on the afternoon of the following day, October 20, 1900, showed the total flow at that point to be 1,871 second-feet.

The following tables show the stage of and draught from Indian Lake Reservoir during the present year, the depth being measured with reference to the inverts of the 5-foot discharge tunnels as a datum. The estimated storage capacity of the reservoir at different depths is as follows:

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[a] Transactions Am. Soc. C. E. Vol. XLIV, p. 283.

	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
[illegible]												
1	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	......
2	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	......
4	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	......
5	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	......
6	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	......
7	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	......
8	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	......
10	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	......
11	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	......
13	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	......
14	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	......
17	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	......
18	......	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	......
19	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......
20	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]
23	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	......	......
24	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]
25	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	......	......
26	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]
27	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]
28	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	......	[illegible]
29	......	......	......	......	......	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
30	......	......	......	......	......	......	[illegible]	[illegible]	......	[illegible]	......	[illegible]
[illegible]												
1	12.[illegible]	9.47	2.92	[illegible]	30.42	35.75	35.25	32.25	32.[illegible]	23.92	22.25	[illegible]
2	12.25	9.42	......	[illegible]	30.42	35.75	35.[illegible]	32.[illegible]	30.92	23.92	22.[illegible]	[illegible]
3	......	9.25	2.42	9.[illegible]	31.17	35.75	35.17	[illegible]	30.75	23.[illegible]	22.50	[illegible]
4	......	......	......	9.[illegible]	31.42	35.67	35.[illegible]	32.[illegible]	30.58	23.58	22.25	[illegible]
5	12.[illegible]	9.42	......	9.42	31.67	35.50	35.17	32.[illegible]	30.42	23.17	22.92	[illegible]
6	......	......	1.92	[illegible]	31.92	35.33	35.17	32.[illegible]	30.25	24.75	22.[illegible]	[illegible]
7	......	......	......	11.50	32.[illegible]	35.33	35.17	32.[illegible]	30.[illegible]	24.33	22.25	[illegible]
8	12.[illegible]	9.[illegible]	......	11.[illegible]	32.[illegible]	35.33	35.17	32.[illegible]	29.[illegible]	24.[illegible]	21.92	[illegible]
9	12.58	...	......	11.50	32.17	35.25	35.17	32.17	29.58	23.67	21.[illegible]	[illegible]
10	......	7.75	[illegible]	11.92	32.25	35.17	35.17	32.33	29.33	23.33	21.[illegible]	[illegible]
11	......	......	[illegible]	12.25	32.50	35.[illegible]	35.17	32.42	29.08	23.[illegible]	[illegible]	[illegible]
12	......	......	2.92	12.67	32.75	35.[illegible]	35.17	32.50	28.75	22.75	[illegible]	[illegible]
13	12.00	7.17	2.[illegible]	13.17	33.[illegible]	34.92	35.21	32.58	28.50	22.50	19.42	[illegible]
14	......	......	3.25	13.67	33.25	34.83	35.25	32.67	28.25	22.[illegible]	19.75	[illegible]
15	......	......	......	14.50	33.[illegible]	34.75	35.25	32.67	28.00	21.58	19.42	[illegible]
16	11.83	6.42	......	15.17	33.42	34.67	35.25	32.71	27.87	21.75	19.50	[illegible]
17	......	......	2.75	16.[illegible]	33.56	34.58	35.33	32.79	27.92	22.92	19.54	[illegible]
18	......	......	......	17.[illegible]	33.75	34.67	35.08	32.83	28.00	23.00	19.58	[illegible]
19	11.50	5.67	......	17.83	33.92	34.75	34.83	32.87	28.04	23.[illegible]	19.[illegible]	[illegible]
20	......	......	4.00	18.50	34.17	34.83	34.58	32.67	28.08	23.25	19.67	[illegible]
21	11.33	......	4.25	19.67	34.33	34.92	34.33	33.[illegible]	28.12	23.33	19.[illegible]	[illegible]
22	......	4.92	4.50	22.00	34.50	35.08	34.00	32.75	28.17	23.43	19.75	[illegible]
23	......	......	4.75	24.17	34.75	35.25	33.75	32.58	28.17	23.58	19.58	[illegible]
24	11.00	......	5.00	25.25	34.92	35.25	33.50	32.50	28.00	23.67	19.25	[illegible]
25	......	4.17	5.25	26.33	35.08	35.25	33.25	32.33	27.67	23.71	18.92	19.42
26	......	......	5.58	27.17	35.25	35.25	33.08	32.17	27.25	23.75	18.58	[illegible]
27	10.50	......	6.33	28.00	35.33	35.25	32.92	32.00	26.67	23.79	18.25	[illegible]
28	......	3.42	6.83	28.58	35.42	35.25	32.75	31.67	26.50	23.83	18.00	[illegible]
29	10.17	......	7.42	29.17	35.50	35.25	32.50	31.58	26.00	23.92	17.67	[illegible]
30	......	......	7.92	29.75	35.67	35.25	32.33	31.42	25.75	23.92	17.33	[illegible]
31	9.83	......	8.17	......	35.75	......	32.33	31.25	......	23.58	......	20.[illegible]

SCHROON RIVER AT WARRENSBURG, WARREN COUNTY, N. Y.

A gauging record was established at the dam of Schroon River Pulp Company, two miles below Warrensburg, November 1, 1895, in connection with Upper Hudson Storage Survey.[a] Conditions at the Warrensburg gauging station are somewhat peculiar. During ordinary water an attempt is made to turn the entire flow of the stream, less leakage, through the water wheels, which run 24 hours per day, Sundays excepted. This is accomplished by the use of flashboards and by draught from the storage impounded by Starbuckville dam. During extreme low water the mill is shut down altogether. As a rule, no water passes over the dam at this time, the entire flow leaking through. A balance is maintained between the inflow and outgo by fluctuations in the pond level, thereby varying the pond storage and also the head on the leaks. As no record is kept when the mill is not running, it has been necessary to estimate the low water flow, which was taken at 150 second-feet in 1899, this being the assumed leakage of the Starbuckville dam.[b]

The apparently uniform regimen of the stream during considerable periods of time may partly be accounted for as the result of draught and storage from the Starbuckville dam.

A current meter measurement of the leakage of the dam, flume, and flashboards, at the Schroon River Pulp Company's Mill was made on August 9, 1900, in the open channel about one-half mile below the dam. The flow at this point was found to be 285 second-feet. This amount has been taken as the low water flow and leakage during 1900 and 1901. The dam is of timber, and was considered nearly water-tight when built. There is evidence that the leakage has increased year by year.

The flow over the dam, without flashboards, has been taken from a diagram, which was deduced from experiments made at Cornell University, on a weir having a similar cross section.

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a See report of State Engineer and Surveyor of New York, 1895, p. 118; also Water Supply and Irrigation Paper No. 35, p. 58.

b See report of the Merchants' Association of New York on the Water Supply of the City of New York, p. 337.

The flow over flashboards has been calculated by means of the Francis formula.

During 1901, the station has been equipped with new standard board gauges. Readings are taken once each day and the record is furnished by Mr. Frank Goodfellow.

High Water Discharge from Schroon River at Warrensburg, Warren County, N. Y.

DATE.	Year.	MAXIMUM DISCHARGE.	
		Second-feet.	Second-feet per square mile.
December 20-21	1895	4,674	7.21
April 20	1896	7,149	12.58
April 19	1897	3,982	7.05
March 14-19	1898	4,044	7.16
April 24-29	1899	5,108	9.88
April 22	1900	7,745	13.71
April 16	1901	6,882	11.19

Mean Daily Flow in Second-feet of Schroon River at Warrensburg, Warren County, N. Y.
[Drainage area, 563 square miles.]

*Sunday.

Mean Daily Flow, in Second-feet, of Schroon River at Warrensburg, Warren County, N. Y.—Continued.

[Drainage area, 563 square miles.]

Day.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]	*
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	*	*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	*	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]	*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	*	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	*	[illegible]	[illegible]	*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]	*
9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	*	*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	*	[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]		[illegible]
12	[illegible]	[illegible]	[illegible]	[illegible]	*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13	*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	*	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	*	[illegible]	[illegible]	*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]*	[illegible]	[illegible]	*
16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	[illegible]	*	*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	*	[illegible]
18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	[illegible]	[illegible]	*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	*	[illegible]	[illegible]
21	[illegible]	[illegible]	[illegible]	*	[illegible]	[illegible]	*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	[illegible]	[illegible]	654	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]	*
23	[illegible]	[illegible]	614	[illegible]	[illegible]	*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24	[illegible]	*	*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	*	[illegible]
25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]	[illegible]	[illegible]
26	[illegible]	[illegible]	[illegible]	[illegible]	*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	*	[illegible]	1,084	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	*	[illegible]	[illegible]
28	612	[illegible]	[illegible]	*	[illegible]	[illegible]	*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	*	[illegible]	[illegible]	*
30	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
31	[illegible]		*		[illegible]		[illegible]	[illegible]		[illegible]		[illegible]
Mean....	774	561	658	4,786	2,235	1,522	617	481	[illegible]	[illegible]	[illegible]	[illegible]

*Sunday.

Mean Monthly Run-off of Schroon River at Warrensburg, Warren County, N. Y.

[Drainage area, 563 square miles.]

MEAN MONTHLY FLOW IN SECOND-FEET.

MONTH.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
January	....	2,779	337	852	686	810	774
February	....	516	188	416	478	1,300	561
March	....	1,064	738	3,194	364	1,140	658
April	....	3,280	3,164	2,853	2,877	3,068	4,786
May	....	728	1,822	2,283	3,150	1,080	2,235
June	....	827	2,384	568	1,068	1,280	1,522
July	....	276	1,426	216	210	528	617
August	....	265	1,377	223	150	474	481
September	....	215	281	106	234	365	690
October	....	330	166	253	482	488	695
November	478	1,069	2,077	464	1,047	530	588
December	1,233	243	2,776	783	948	778	714

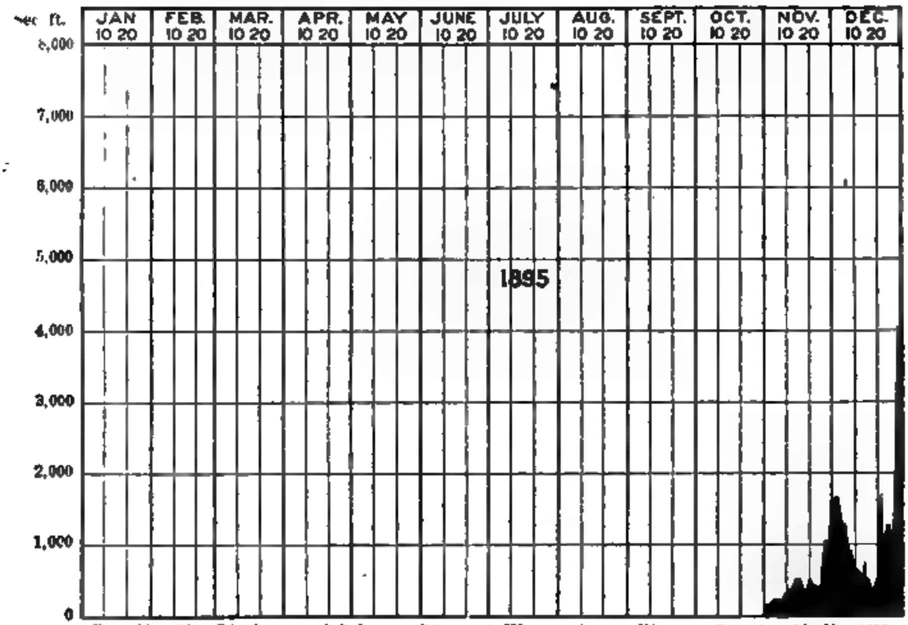

Fig. No. 88.—Discharge of Schroon River at Warrensburg, Warren County, N. Y., 1895.

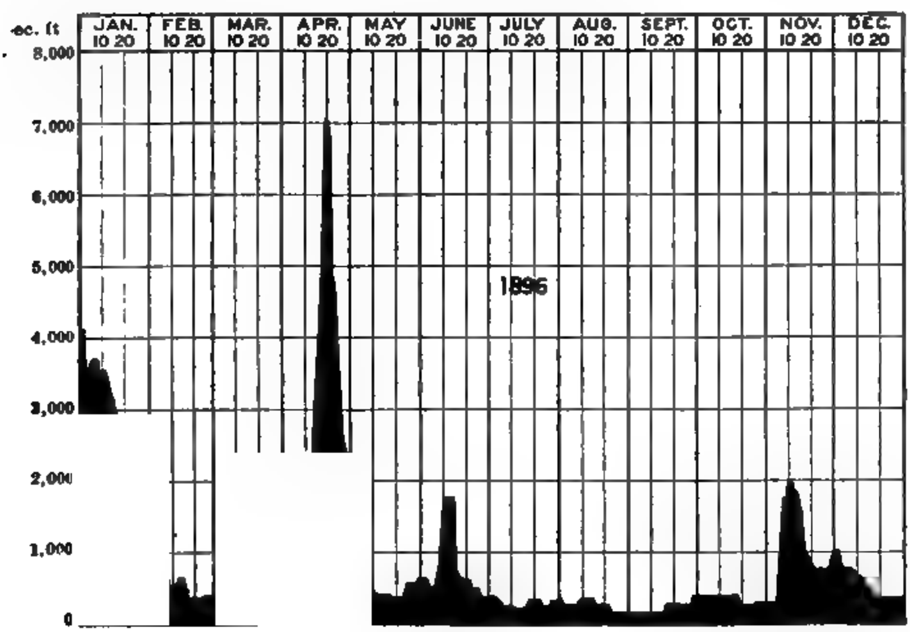

Fig. No. 89.—Discharge of Schroon River at Warrensburg, Warren County, N. Y., 1896.

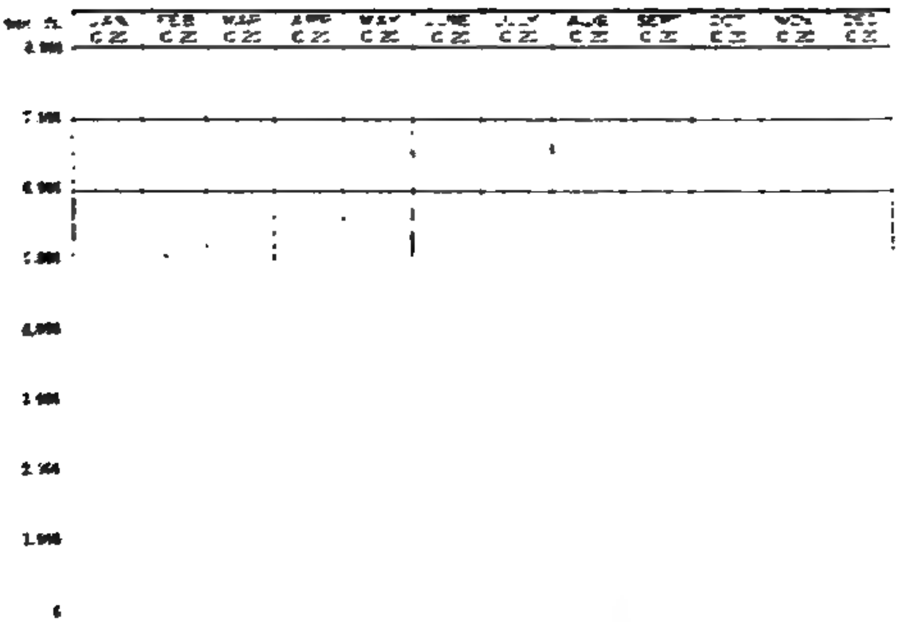

Fig. No. 90.—Discharge of Schroon River at Warrensburg, Warren County, N. Y., 1897.

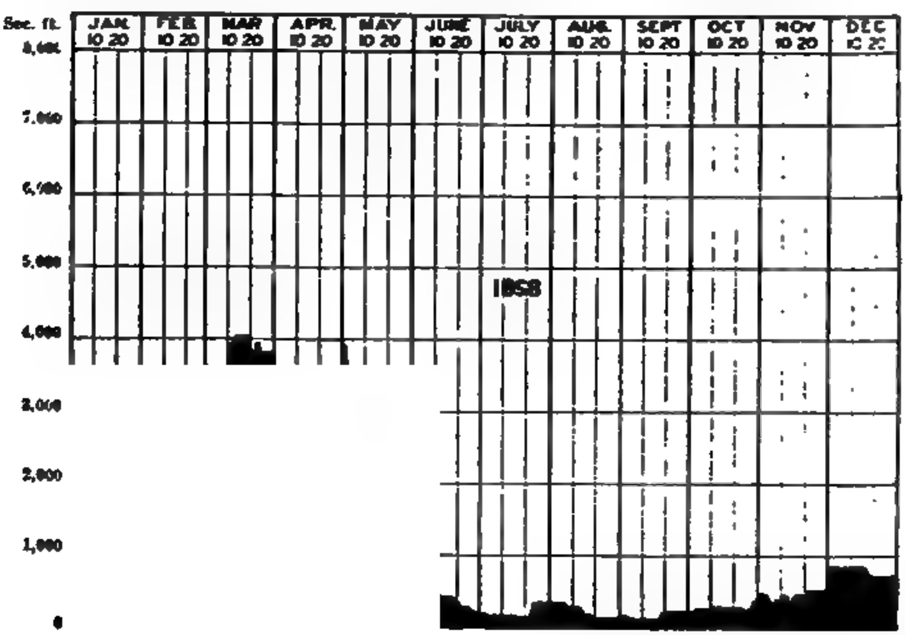

Fig. No. 91.—Discharge of Schroon River at Warrensburg, Warren County, N. Y., 1898.

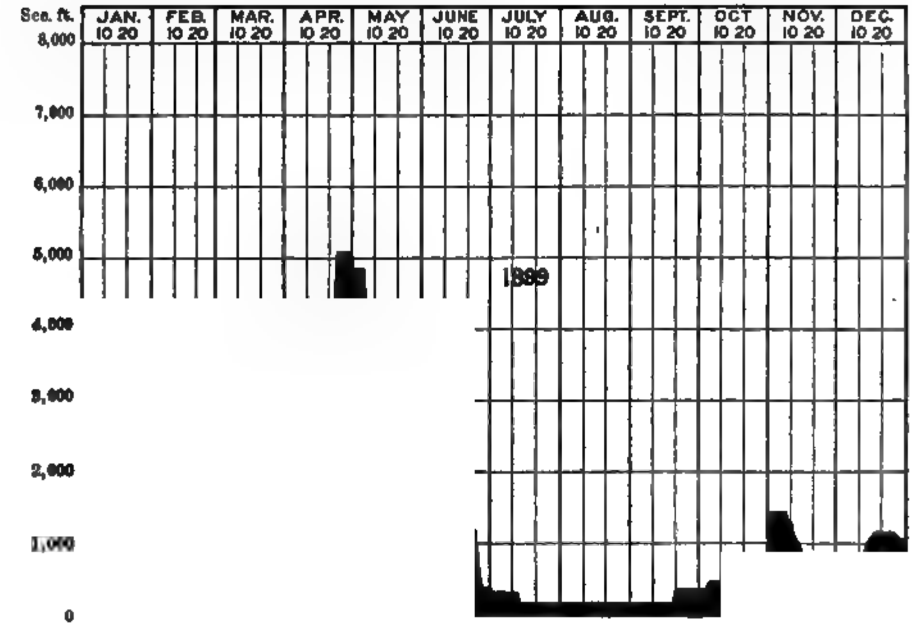

Fig. No. 92.—Discharge of Schroon River at Warrensburg, Warren County, N. Y., 1899.

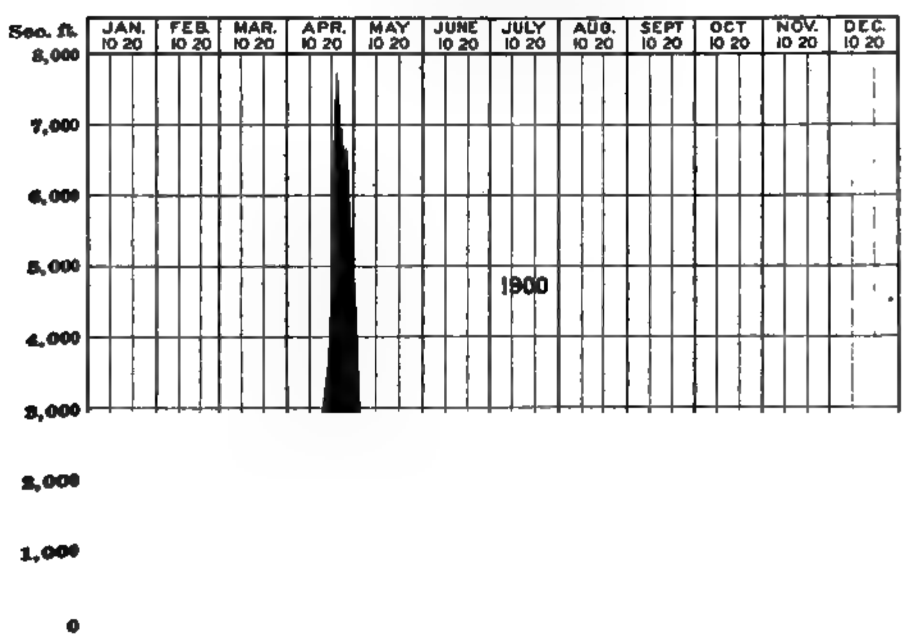

Fig. No. 93.—Discharge of Schroon River at Warrensburg, Warren County, N. Y., 1900.

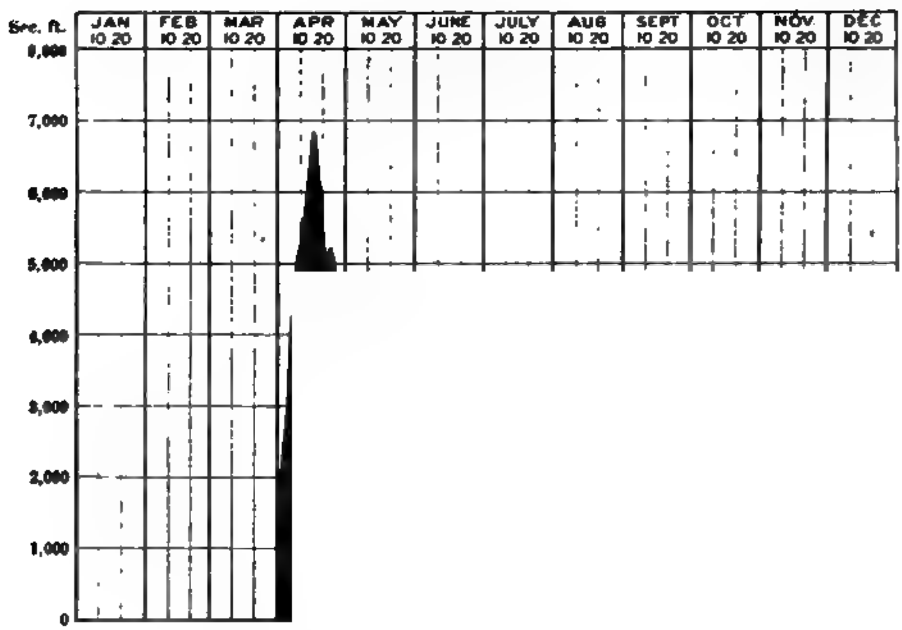

Fig. No. 94.—Discharge of Schroon River at Warrensburg, Warren County, N. Y., 1901.

Mean Monthly Run-off of Schroon River at Warrensburg, Warren County, N. Y.—(Concluded.)

SECOND-FEET PER SQUARE MILE.

MONTH.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
January	....	4.92	0.60	1.16	1.25	1.44	1.38
February	....	0.92	0.33	0.74	0.85	2.45	1.00
March	....	2.96	1.31	5.68	1.00	2.02	1.17
April	....	5.83	5.80	5.07	5.11	6.55	8.48
May	....	1.11	3.24	3.91	5.60	3.00	3.96
June	....	1.47	4.24	1.01	1.94	2.27	2.69
July	....	0.49	2.54	0.38	0.37	0.94	1.09
August	....	0.47	2.45	0.40	0.27	0.84	0.85
September	....	0.38	0.50	0.30	0.41	0.50	1.15
October	....	0.59	0.29	0.47	0.82	0 86	1.21
November	0.85	1.94	3.69	0.82	1.86	0.94	1.05
December	2.19	0.43	4.93	1.40	1.68	1.37	1.27

INCHES ON DRAINAGE AREA.

MONTH.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
January	....	5.70	0.69	1.75	1.25	1.66	1.59
February	....	0.95	0.35	0.77	0.89	2.54	1.04
March	....	3.41	1.51	6.55	1.16	2.33	1.35
April	....	6.51	6 28	5.66	5.72	7.31	9.50
May	....	1.49	3.73	4.52	6.47	3.46	4.55
June	....	1.64	4.73	1.13	2.17	2.53	3.01
July	....	0.56	2.92	0.44	0.43	1.05	1.24
August	....	0.54	2.82	0.46	0.31	0.97	0.98
September	....	0.43	0.56	0.33	0.46	0.56	1.29
October	....	0.68	0.33	0.54	0.95	0.99	1.39
November	0.94	2.16	4.12	0.92	2.08	1.05	1.18
December	2 53	0.48	5.69	1.61	1.93	1.58	1.46

HUDSON RIVER AT FORT EDWARD, WASHINGTON COUNTY, N. Y.

This station, which is located at the dam of the International Paper Company, was established in 1895, in connection with Upper Hudson storage surveys.[a] The dam is of framed timber on slate rock foundation, and has but little leakage. The crest is straight, very nearly level, and 587.6 feet in length. The crest gauge zero stands at the level of the lip of the dam proper. Flashboards are usually maintained on the dam from 15 inches to 18 inches in height. A record is kept of the height of flashboards, and of the times of their setting and removal.

[a] See Report of State Engineer and Surveyor of New York 1895, p. 105.

During 1901, the station has been equipped with new metallic gauges of standard form. The crest gauge is attached vertically to the timber bulkhead above the left-hand end of the dam. The gauges are divided to feet and inches, and readings are taken each morning by Frank Chapman.

There are 62 water wheels in the adjoining mill. These are nearly all of modern types which have been tested at the Holyoke flume. A record is kept of the daily run of each in hours, as well as of the working head, which is usually 19 feet. The discharge through the turbines is taken from diagrams expressing the flow as a function of the working head and number of wheel-hours run.

In the winter of 1896-1897, a flood spillway was cut around the south end of the dam, over which the water begins to flow whenever it reaches the level of the crest of the flashboards. The profile of the spillway is very irregular and causes some uncertainty in the calculated flows during times of high water.

Whenever the flashboards are off from the main dam the flow is computed by means of the formula used by the East Indian engineers in their computations for irrigation works.[a]

With the flashboards on, the flow has been computed from Francis' well-known formula for the sharp-edged weir. During the dry season but little water passes over the dam, the entire flow being employed to drive the turbines. A current meter measurement was made at the highway bridge below the dam on July 26, 1900. The flow was found to be 2,704 second-feet.

The calculated discharge from the gauge readings at the dam and mill varied from 2,420 to 2,720 second-feet while the measurement was being taken. The turbines did not run continuously for 24 hours at this rate however. The mean flow for the day was 1,467 second-feet.

During the navigation season water is diverted from Hudson River at Glens Falls feeder dam, 7 miles above Fort Edward, for the supply of Champlain Canal.

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[a] See p. 354.

The drainage area tributary to the Hudson above Fort Edward is 0.56 of that of the same stream above Mechanicville gauging station. The principal intervening tributaries are the Hoosic River and Batten Kill, having drainage areas of 730 and 460 square miles respectively.[a]

High Water of Hudson River at Fort Edward, Washington County, N. Y.

DATE.	MAXIMUM DISCHARGE.	
	Second-feet.	Second-feet per square mile.
April 18, 1896	42,620	15.2
November 7, 1896	24,550	8 7
April 12, 1897	23,732	8.5
June 12, 1897	23,242	8.3
December 17, 1897	27,920	10.0
March 16, 1898	29,856	10.7
April 25, 1898	32,159	11.5
April 23, 1900	43,900	15.7
April 28, 1901	42,820	15.3

[a] Water Power of Upper Hudson River is described in Report of New York State Engineer and Surveyor 1895; pp. 124-154.

Mean Daily Flow in Second-feet of [illegible] River at [illegible], [illegible] County, N. Y.

[Drainage area, [illegible] square miles.]

DAY	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1899.												
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	——*	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	——	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	——	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	——	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	——	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	——	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	——	[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	574	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	574	[illegible]	[illegible]	3,135	[illegible]
16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	574	[illegible]	[illegible]	[illegible]	[illegible]
17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	575	[illegible]	[illegible]
18	[illegible]	[illegible]	4,335	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	576	3,133	[illegible]
19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	961	[illegible]	[illegible]
21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1,445	[illegible]	964	[illegible]	[illegible]	[illegible]
22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2,900	[illegible]
23	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	500	[illegible]	[illegible]	[illegible]	1,466	[illegible]	[illegible]
24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2,311	[illegible]
25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	923	[illegible]	[illegible]
26	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	918	[illegible]	[illegible]
27	[illegible]	2,253	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	919	[illegible]	[illegible]
28	[illegible]	2,642	5,444	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29	[illegible]	....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	576	[illegible]	[illegible]	[illegible]	[illegible]
30	[illegible]	....	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	576	[illegible]	1,183	[illegible]	[illegible]
31	[illegible]	....	[illegible]	....	[illegible]	....	461	[illegible]	....	1,183	....	[illegible]
Mean	3,527	1,902	5,096	[illegible]	9,561	1,617	1,150	714	1,367	1,033	[illegible]	[illegible]
1900.												
1	3,301	3,421	2,879	3,737*	12,436	4,924	175*	1,927	1,044	827	1,020	[illegible]
2	1,267	[illegible]	[illegible]	4,332	[illegible]	4,924	827	[illegible]	956*	827	1,266	[illegible]
3	1,967	3,221	4,362	5,261	[illegible]	3,422*	827	[illegible]	190	827	1,406	7,657
4	1,267	[illegible]	[illegible]	5,791	11,626	4,921	[illegible]	[illegible]	1,445	827	302*	[illegible]
5	1,967	[illegible]	4,462	[illegible]	9,646	5,094	1,216	[illegible]	827	827	1,462	[illegible]
6	2,053	2,447	[illegible]	7,376	[illegible]	4,674	931	[illegible]	715	827	834	[illegible]
7	1,461*	2,447	[illegible]	10,566	7,251	4,419	[illegible]	[illegible]	827	20*	1,226	[illegible]
8	2,217	2,447	3,741	11,360*	8,246	4,440	1,215*	1,350	827	1,466	1,006	[illegible]
9	2,217	3,221	3,471	[illegible]	[illegible]	[illegible]	[illegible]	1,579	827*	1,216	1,119	[illegible]
10	2,217	[illegible]	[illegible]	11,636	[illegible]	[illegible]	[illegible]	1,740	1,211	1,216	2,203	2,454
11	2,217	[illegible]	[illegible]	11,636	[illegible]	[illegible]	[illegible]	[illegible]	1,211	[illegible]	875*	[illegible]
12	2,217	[illegible]	3,479	11,636	[illegible]	3,201	[illegible]	[illegible]	1,211	1,238	2,203	[illegible]
13	2,217	[illegible]	[illegible]	10,776	[illegible]	[illegible]	841	[illegible]	827	1,366	2,203	2,656
14	1,571*	[illegible]	3,723	10,776	[illegible]	[illegible]	1,467	2,565	1,579	872*	[illegible]	[illegible]
15	2,217	17,747	3,759	[illegible]	[illegible]	2,951	[illegible]	3,019	1,293	1,618	1,947	[illegible]
16	2,217	[illegible]	3,571	10,776	7,248	2,268	2,171	[illegible]	685*	1,504	1,001	965*
17	2,217	[illegible]	[illegible]	[illegible]	[illegible]	795*	[illegible]	3,347	1,233	1,306	2,947	2,275
18	2,217	[illegible]	[illegible]	[illegible]	[illegible]	2,941	[illegible]	[illegible]	1,233	1,450	1,133*	[illegible]
19	2,217	15,531	3,479	[illegible]	5,961	1,677	954	1,410*	1,112	1,246	2,040	[illegible]
20	2,217	9,340	3,479	31,495	3,015*	1,957	1,360	2,242	1,112	1,224	1,901	[illegible]
21	[illegible]	9,141	[illegible]	[illegible]	7,242	2,407	1,268	1,250	1,211	872*	4,863	[illegible]
22	[illegible]	[illegible]	4,942	[illegible]	[illegible]	1,915	[illegible]	1,534	1,175	1,611	7,074	[illegible]
23	7,312	7,013	4,942	[illegible]	6,336	1,979	[illegible]	977	912*	1,040	10,213	1,795
24	7,577	[illegible]	4,942	36,061	5,111	20*	1,338	940	1,612	1,118	6,482	[illegible]
25	[illegible]	[illegible]	2,911*	30,945	3,677	[illegible]	2,033	901	1,061	1,106	3,260*	[illegible]
26	[illegible]	[illegible]	4,742	26,635	4,912	2,191	1,467	95*	1,557	1,251	[illegible]	[illegible]
27	[illegible]	4,232	4,742	23,536	415*	1,178	3,441	928	1,329	1,773	....	3,136
28	2,041*	4,045	[illegible]	18,480	4,366	2,181	3,263	928	1,435	804*	....	[illegible]
29	5,212	....	[illegible]	14,250*	4,319	1,241	175*	1,487	1,180	2,703	....	[illegible]
30	4,287	....	4,942	14,210	3,372	1,069	[illegible]	1,531	865*	2,447	....	[illegible]
31	3,571	....	4,942	....	3,460	....	1,656	1,791	....	1,647	....	[illegible]
Mean	3,211	7,074	3,934	16,914	6,358	2,834	1,248	1,652	1,110	1,243	2,670	[illegible]

*Sunday.

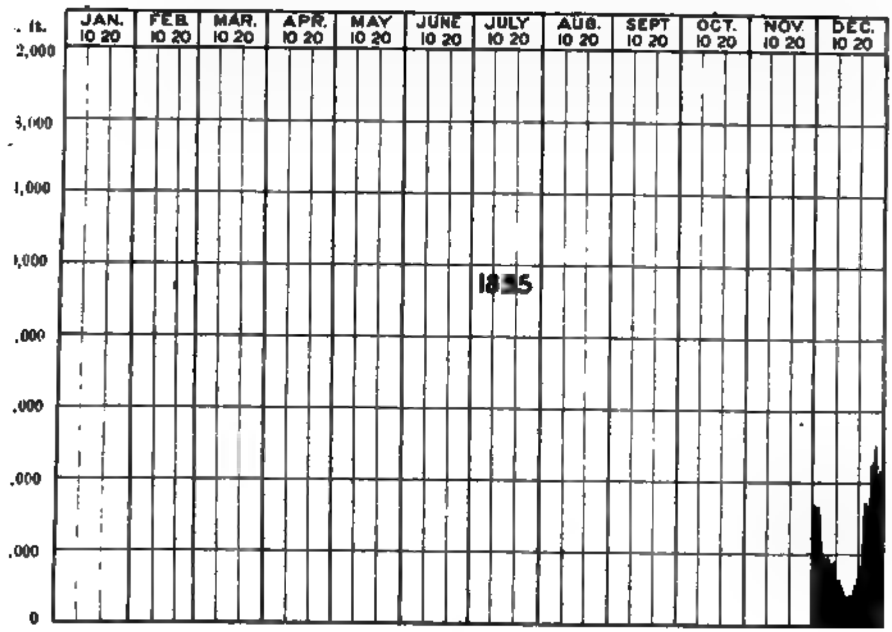

Fig. No. 95.—Discharge of Hudson River at Fort Edward, Washington County, N. Y., 1895.

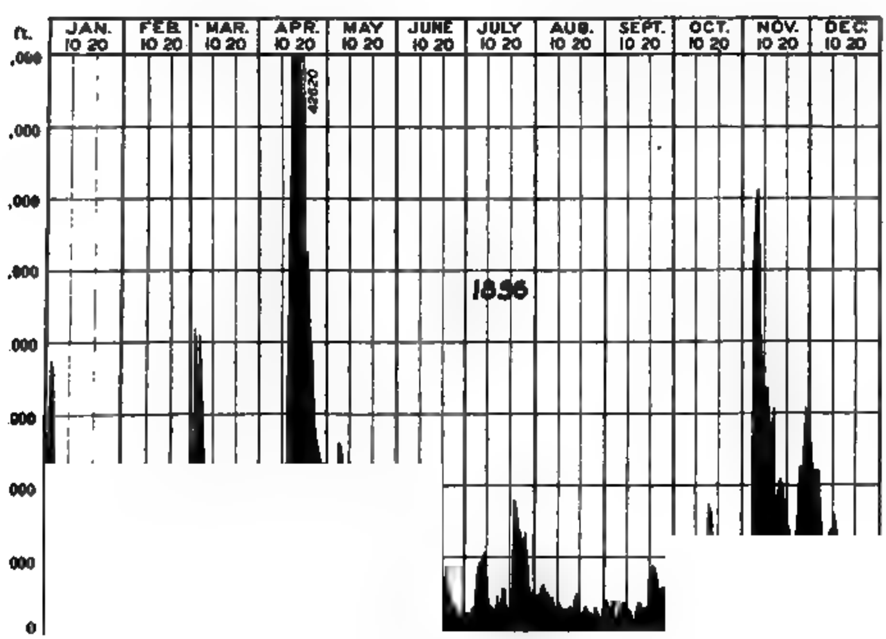

Fig. No. 96.—Discharge of Hudson River at Fort Edward, Washington County, N. Y., 1896.

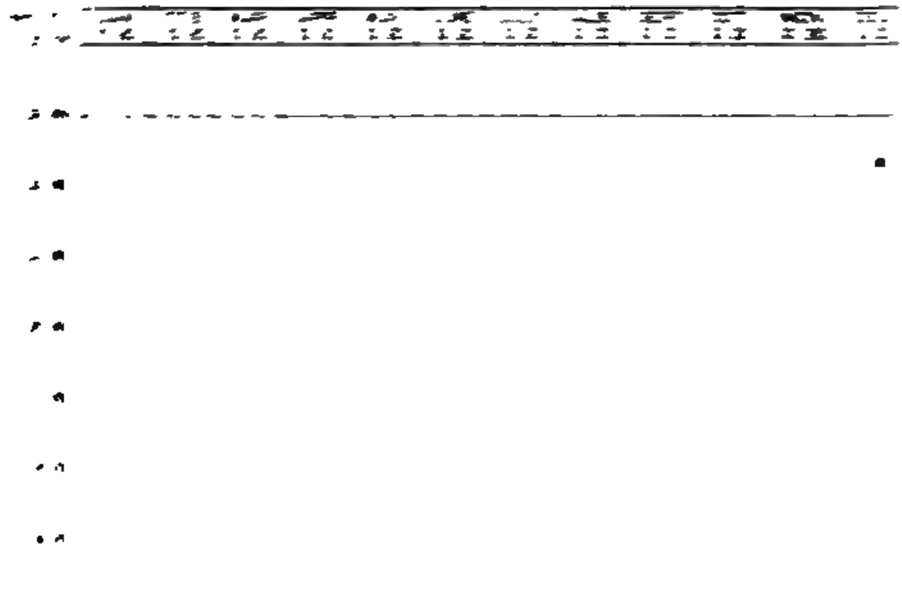

Fig. No. [illegible]—Discharge of Hudson River at Fort Edward, Washington County, N. Y.

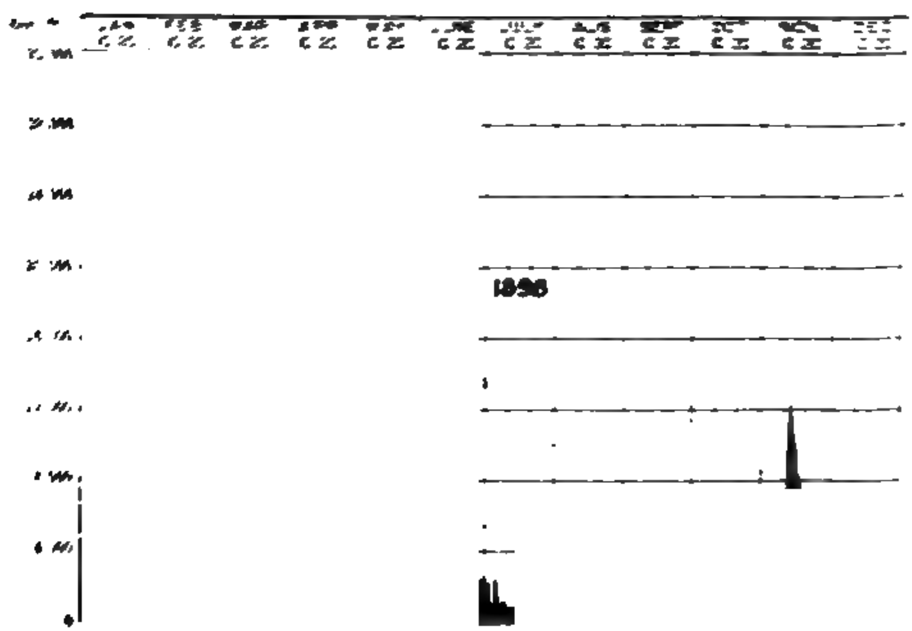

Fig. No. [illegible]. Discharge of Hudson River at Fort Edward, Washington County, N. Y. [illegible]

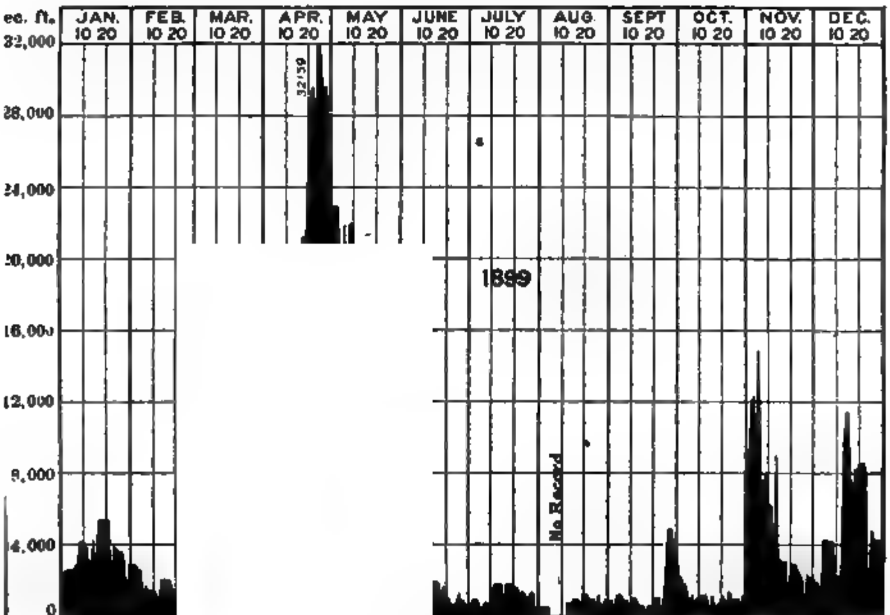

Fig. No. 99.—Discharge of Hudson River at Fort Edward, Washington County, N. Y., 1899.

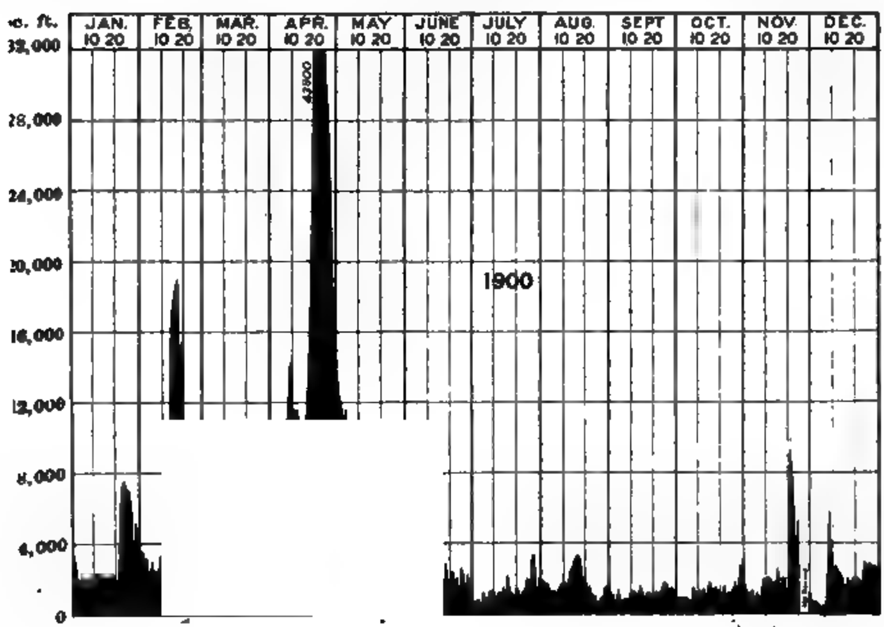

Fig. No. 100.—Discharge of Hudson River at Fort Edward, Washington County, N. Y., 1900.

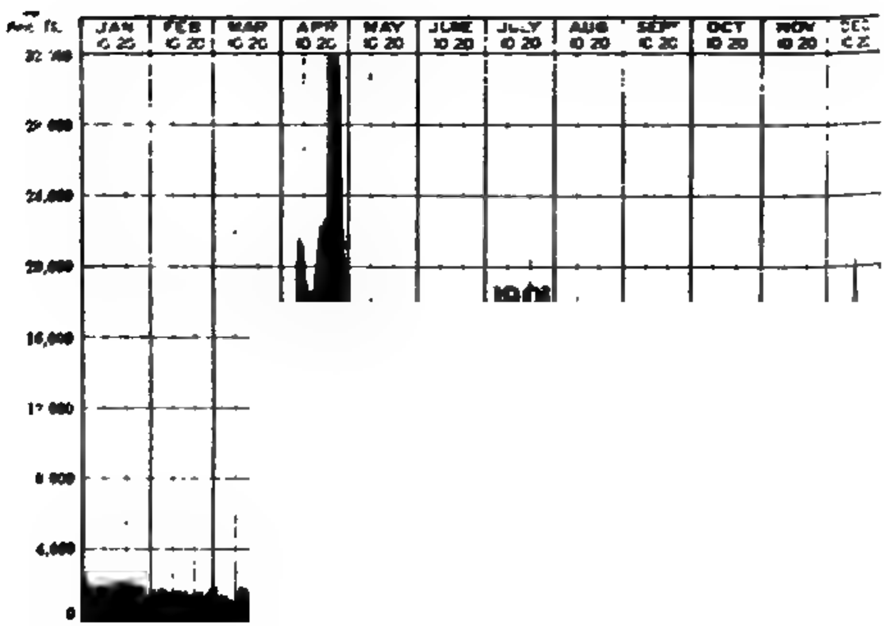

Fig. No. 101.—Discharge of Hudson River at Fort Edward, Washington County, N. Y., [illegible]

Mean Daily Flow in Second-feet of the Hudson River at Fort Edward, Washington County, N. Y.—(Concluded.)

[Drainage area, 2,800 square miles.]

* Sunday.

Mean Monthly Run-off of Hudson River at Fort Edward, Washington County, N. Y.

[Drainage area, 2,800 square miles.]

SECOND-FEET.

MONTH.	1899.	1900.	1901.
January	3,527	3,211	1,627
February	1,902	7,074	1,547
March	5,006	3,934	8,445
April	16,811	16,914	21,154
May	9,561	6,358	8,295
June	1,617	2,681	6,256
July	1,150	1,248	2,190
August	714	1,652	2,531
September	1,347	1,110	2,463
October	1,033	1,343	2,679
November	5,096	6,077	3,128
December	5,157	5,381	4,771

[illegible]

[illegible]

Month	[illegible]	[illegible]	[illegible]
January	[illegible]	[illegible]	[illegible]
February	[illegible]	[illegible]	[illegible]
March	[illegible]	[illegible]	[illegible]
April	[illegible]	[illegible]	[illegible]
May	[illegible]	[illegible]	[illegible]
June	[illegible]	[illegible]	[illegible]
July	[illegible]	[illegible]	[illegible]
August	[illegible]	[illegible]	[illegible]
September	[illegible]	[illegible]	[illegible]
October	[illegible]	[illegible]	[illegible]
November	[illegible]	[illegible]	[illegible]
December	[illegible]	[illegible]	[illegible]

[illegible]

Month	[illegible]	[illegible]	[illegible]
January	[illegible]	[illegible]	[illegible]
February	[illegible]	[illegible]	[illegible]
March	[illegible]	[illegible]	[illegible]
April	[illegible]	[illegible]	[illegible]
May	[illegible]	[illegible]	[illegible]
June	[illegible]	[illegible]	[illegible]
July	[illegible]	[illegible]	[illegible]
August	[illegible]	[illegible]	[illegible]
September	[illegible]	[illegible]	[illegible]
October	[illegible]	[illegible]	[illegible]
November	[illegible]	[illegible]	[illegible]
December	[illegible]	[illegible]	[illegible]

HUDSON RIVER AT MECHANICVILLE, SARATOGA COUNTY, N. Y.

A record of the flow of Hudson River at Mechanicville has been kept by the Duncan Company, beginning December, 1888. The record includes two daily readings of the depth on the crest of the dam, and a continuous record of the run of the water wheels in the adjoining paper mill. The accompanying tables show the monthly and daily mean flow at Mechanicville, computed by Mr. R. P. Bloss, the engineer of the company. A record is kept of the length and height of the flashboards at all times, with the dates of their setting and removal.

The flow over the dam has been computed by the Francis formula for the Merrimac dam:

$$Q = 3.012\, L\, H^{1.[illegible]}$$

L being 794 feet. H = depth on crest of dam in feet. The same formula has been used in all cases, whether flashboards are on or off.

The flow through the water wheels has been taken from the rating tables of the manufacturers. The working head on the wheels varies from 15 to 17 feet, depending on the condition of the flashboards on the dam. A test, by Mr. Bloss, of a 39-inch Hercules wheel in the mill, which has been in use about eight years, shows the actual discharge to be substantially as given in the manufacturers tables when running at the speed of greatest efficiency. When running at higher speed the discharge may be several per cent. less.

A current meter measurement of the flow below the dam was made at the Mechanicville toll bridge October 20, 1900, showing a discharge of 1,871 second-feet. The result is somewhat uncertain, owing to slack water. No water was flowing over the dam, and the calculated turbine discharge was 1,977 second-feet.

The flow of Hudson River at Mechanicville has been calculated using the East Indian engineers' formula for flow over the dam.[a] This formula gives a somewhat larger discharge than that obtained by using the formula given below.

The highest flood since the record has been kept occurred April 19, 1896, and showed a discharge of 59,400 second-feet or 13.2 second-feet per square mile.

The highest known freshet discharge of Hudson River occurred in the spring of 1869. The calculated discharge at Mechanicville was 70,000 second-feet or 15.5 second-feet per square mile.[b]

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[a] See Report of State Engineer and Surveyor of New York, 1895, pp. 104–107.

[b] A list of Hudson River high-water marks is given by G. L. Harrison, in Report of U. S. Board of Engineers on Deep Waterways, 1900, Pt. 1, pp. 877–878.

Mean Daily Flow in Second-feet of Hudson River at Mechanicville, Saratoga County, N. Y.

[Drainage area, [illegible] square miles.]

DAY	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1899												
1	4,222	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	......*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	......*	......*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	......*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]	[illegible]*
12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]	......*	......*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]
14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	......*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]
17	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]	[illegible]*
19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	[illegible]	......*	......*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]
21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]	[illegible]	[illegible]
22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23	......*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]
24	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]	[illegible]*
26	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	[illegible]	......*	......*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]
28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]	[illegible]	[illegible]
29	[illegible]	......	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
30	......*	......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	[illegible]
31	4,822	......	[illegible]	......	[illegible]	......	[illegible]*	[illegible]	......	[illegible]	......	[illegible]
Mean.	2,173	[illegible]	19,617	[illegible]	[illegible]	[illegible]	2,751	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1900												
1	4,262*	2,916	7,847	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1,713	......*	[illegible]	[illegible]
2	4,262	[illegible]	[illegible]	[illegible]*	27,617	[illegible]	[illegible]*	[illegible]	1,561	4,062	[illegible]	[illegible]
3	5,200	[illegible]	6,463	6,265	25,551	3,601	2,123	1,213	......*	3,453	[illegible]	[illegible]*
4	[illegible]	[illegible]	......	[illegible]	22,472	[illegible]*	......	1,153	[illegible]	[illegible]	[illegible]	3,545
5	[illegible]	[illegible]*	......*	[illegible]	[illegible]	[illegible]	2,741	[illegible]	[illegible]	2,745	[illegible]*	[illegible]
6	[illegible]	4,223	[illegible]	[illegible]	15,152	[illegible]	1,610	......*	1,764	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]*	[illegible]	1,670	[illegible]	[illegible]	2,571	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1,211	[illegible]	[illegible]	......*	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]*	9,270	2,525	......*	1,475	[illegible]	2,500	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]	8,587	2,290	3,000	[illegible]	......*	2,712	[illegible]	[illegible]*
11	[illegible]	[illegible]	[illegible]	[illegible]	7,446	......*	2,531	1,168	[illegible]	[illegible]	6,182	[illegible]
12	[illegible]	[illegible]*	[illegible]*	[illegible]	7,550	2,300	[illegible]	903	[illegible]	2,674	[illegible]*	[illegible]
13	5,272	[illegible]	15,437	17,745	7,155	2,565	3,213	......*	1,471	[illegible]	[illegible]	11,183
14	[illegible]	[illegible]	12,152	[illegible]	7,050*	2,230	[illegible]	1,580	1,567	2,353	5,536	14,570
15	7,435*	[illegible]	[illegible]	27,975	7,772	2,135	[illegible]	[illegible]	1,484	......*	[illegible]	[illegible]
16	[illegible]	[illegible]	[illegible]	[illegible]*	7,346	2,078	......*	1,501	[illegible]	2,177	[illegible]	[illegible]
17	10,155	[illegible]	[illegible]	31,112	[illegible]	3,060	2,881	1,815	......*	2,132	[illegible]	[illegible]*
18	[illegible]	[illegible]	7,895	29,667	5,720	[illegible]*	3,338	[illegible]	711	1,853	4,857	9,534
19	[illegible]	[illegible]*	[illegible]*	29,711	5,928	[illegible]	2,660	1,300	[illegible]	[illegible]	[illegible]*	[illegible]
20	[illegible]	5,267	11,350	33,910	5,917	2,508	2,560	......*	957	[illegible]	[illegible]	10,950
21	[illegible]	[illegible]	9,670	[illegible]	5,925*	2,372	2,485	1,610	941	2,185	[illegible]	11,044
22	5,770*	[illegible]	9,337	38,210	6,187	2,280	2,285	1,123	1,448	......*	[illegible]	10,721
23	[illegible]	[illegible]	8,645	37,146*	5,313	2,105	......*	1,743	1,464	[illegible]	[illegible]	[illegible]
24	[illegible]	[illegible]	8,657	[illegible]	4,756	1,878	2,240	[illegible]	......*	[illegible]	[illegible]	[illegible]*
25	[illegible]	[illegible]	[illegible]	[illegible]	4,710	301*	2,273	[illegible]	1,516	2,372	3,731	8,241
26	[illegible]	[illegible]*	[illegible]*	41,475	4,462	1,678	[illegible]	[illegible]	2,116	[illegible]	3,473*	[illegible]
27	[illegible]	[illegible]	[illegible]	40,664	4,117	2,211	2,021	......*	6,000	[illegible]	[illegible]	[illegible]
28	[illegible]	10,328	[illegible]	38,300	3,985*	2,290	2,140	1,756	5,127	2,216	[illegible]	5,435
29	[illegible]*	......	7,835	[illegible]	4,125	[illegible]	[illegible]	1,738	[illegible]	......*	[illegible]	[illegible]
30	[illegible]	......	8,765	30,292*	3,787	2,512	......*	1,739	4,870	[illegible]	3,318	4,075
31	[illegible]	......	7,662	......	[illegible]	......	[illegible]	1,477	......	3,815	......	2,565*
Mean.	6,437	5,141	9,316	24,607	9,591	2,539	2,402	1,417	2,054	2,616	[illegible]	7,303

* Sundays. † Discharge August 25 to September 4 approximate, owing to irregular flashboards.

Mean Daily Flow in Second-feet of Hudson River at Mechanicville, Saratoga County, N. Y. —(Concluded).

[Drainage area, 4,500 square miles]

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a Record approximate, flashboards irregular. * Sunday

Run-off of Hudson River at Mechanicville, Saratoga County, N. Y. Calculated by means of the East Indian Engineers' Formula. (a)

[Drainage area, 4,500 square miles.]

MEAN MONTHLY FLOW IN SECOND-FEET.

...9.	18[illegible]9
...28	6,063
...54	5,256
...30	9,618
...12	23,646
...35	9,752
...30	2,566
...70	2,273
...01	1,[illegible]
...72	2,074
...35	2,617
[illegible]	6,[illegible]
[illegible]	7,[illegible]

a Report on Water Supply of City of New York by the Merchants' Association, pp. 333–335.

MEAN MONTHLY FLOW IN SECOND FEET PER SQUARE MILE.

MONTH.	1888.	1889.	1890.	1891.	1892.	1893.	[illegible]	1895.	[illegible]	1897	1898.	1899.
January	1.41	2.44	2.56	1.64	4.18	0.71	1.50	0.86	1.51	0.89	1.72	1.49
February	0.82	0.84	1.76	2.56	3.06	1.07	1.06	0.79	1.04	0.87	1.50	1.17
March	1.52	1.84	2.47	3.94	2.43	1.83	3.28	0.88	3.02	2.49	4.49	2.14
April	4.73	3.04	3.34	4.44	4.78	[illegible]	2.47	5.81	5.56	4.24	3.07	5.25
May	4.76	1.97	4.00	1.22	4.30	4.96	1.69	1.52	1.02	2.70	2.47	2.17
June	1.09	1.52	1.64	0.71	2.76	1.07	1.58	0.83	1.05	3.64	1.17	0.58
July	0.34	1.28	0.43	0.55	2.08	0.56	0.70	0.60	0.63	2.39	0.57	0.54
August	0.38	0.95	0.45	0.50	1.29	1.11	0.55	0.57	0.54	1.68	1.12	0.31
September	0.63	0.44	1.96	0.45	0.99	1.53	0.41	0.56	0.51	0.51	0.84	0.46
October	1.02	0.83	2.04	0.33	0.63	0.86	0.81	0.56	0.91	0.56	1.75	0.56
November	2.36	1.77	2.09	0.91	1.69	0.81	1.42	1.87	2.97	3.21	2.05	1.42
December	2.22	2.08	0.72	1.91	0.90	1.66	0.97	3.42	1.54	3.06	1.32	b1.02

RUN-OFF IN INCHES ON DRAINAGE AREA.

MONTH.	1888	1889.	1890.	1891.	[illegible]	[illegible]	1894.	1895.	1896.	1897.	1898.	[illegible]
January	1.63	2.81	[illegible]	[illegible]	4.83	0.82	1.73	1.99	1.74	1.08	1.97	1.71
February	89	0.88	1.83	2.70	2.22	1.09	1.12	0.82	1.12	0.90	1.56	1.22
March	1.75	2.12	2.85	4.56	2.80	2.11	3.78	1.08	3.49	3.13	5.18	2.47
April	5.26	3.39	3.72	4.97	5.25	4.44	2.76	6.91	6.20	4.73	3.40	5.86
May	5.49	2.27	4.59	1.42	5.03	5.71	[illegible]	[illegible]	1.18	3.04	2.85	2.49
June	1.22	1.70	[illegible]	0.79	3.09	1.19	1.76	0.70	1.16	2.94	1.30	0.65
July	0.39	1.47	0.50	0.60	2.38	0.65	0.81	0.66	0.72	2.74	0.64	0.62
August	0.44	1.09	0.52	[illegible]	1.41	1.28	0.63	1.00	0.63	2.41	1.30	0.36
September	0.71	0.49	2.19	0.51	1.10	1.70	0.47	0.65	0.71	0.68	0.96	0.51
October	1.18	0.96	2.36	0.38	0.72	0.99	0.94	0.69	1.05	.65	2.12	0.67
November	2.64	1.96	2.28	1.01	1.89	0.90	1.58	2.08	3.52	2.47	2.29	1.58
December	3.57	3.39	0.83	2.27	1.08	1.85	1.12	2.79	1.77	3.67	1.40	.....

Fig. No. 102.—Discharge of Hudson River at Mechanicville, Saratoga County, N. Y., 1898.

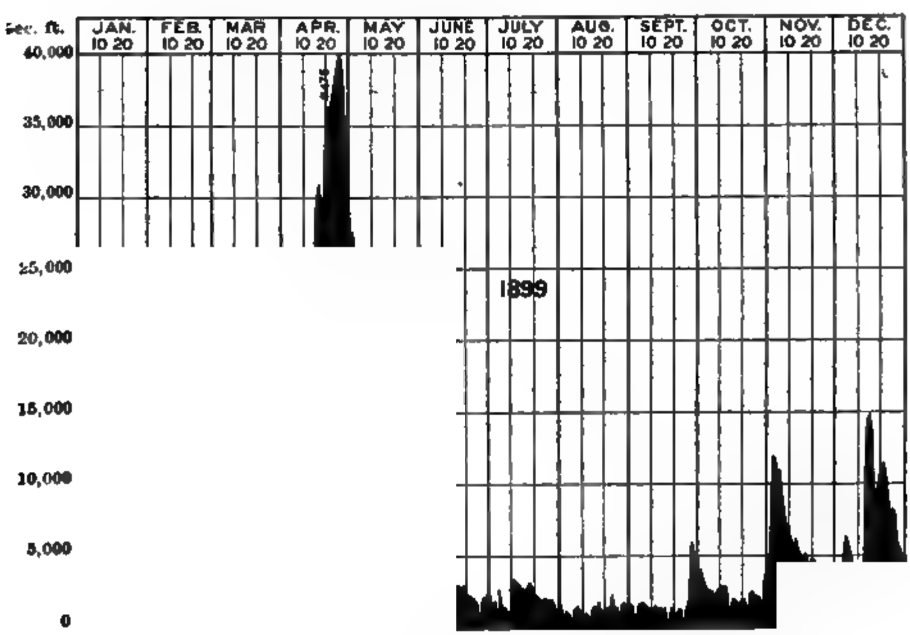

Fig. No. 103.—Discharge of Hudson River at Mechanicville, Saratoga County, N. Y., 1899.

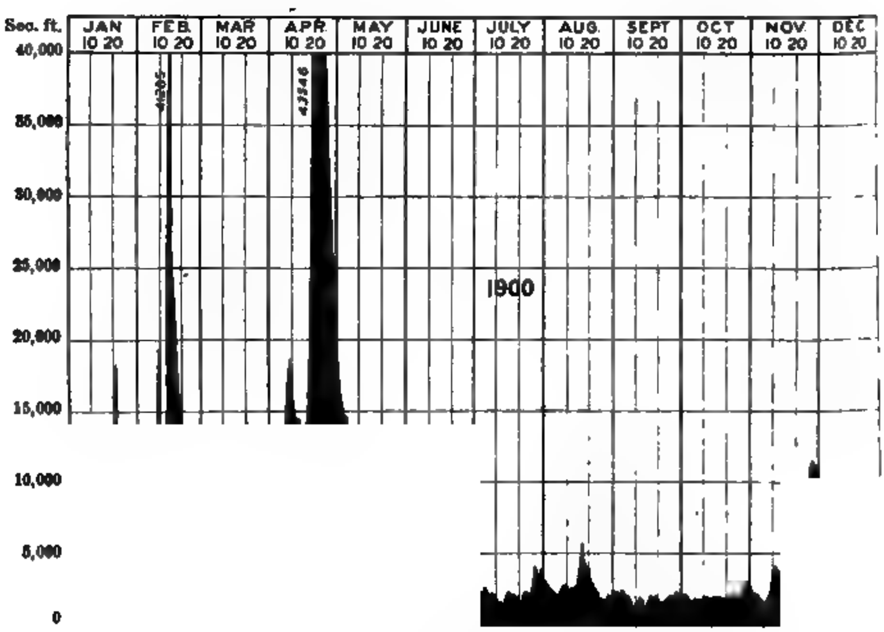

Fig. No. 104.—Discharge of Hudson River at Mechanicville, Saratoga County, N. Y., 1900

Mean Monthly Run-off of Hudson River at Mechanicville, Saratoga County, N. Y., Calculated by Means of Francis' Formula for Merrimac Dam.

[Drainage area 4,500 square miles.]

MEAN MONTHLY FLOW IN SECOND-FEET.

MONTH.	1898.	1899.	1900.	1901.
January	8,173	6,437	5,841	3,087
February	6,038	5,141	12,484	2,888
March	19,617	9,316	7,740	8,095
April	13,047	24,607	22,614	28,268
May	10,525	9,591	8,992	11,658
June	5,069	2,539	4,093	7,808
July	2,751	2,402	2,352	3,551
August	5,029	1,417	2,703	4,661
September	3,810	2,054	1,886	4,024
October	7,516	2,616	2,128	4,264
November	8,978	6,066	5,077	3,732
December	5,291	7,303	5,331	8,491

SECOND-FEET PER SQUARE MILE.

MONTH.	1898.	1899.	1900.	1901.
January	1.81	1.43	1.30	.69
February	1.34	1.14	2.77	.64
March	4.36	2.07	1.72	1.80
April	2.90	5.47	5.02	6.28
May	2.34	2.11	2.00	2.60
June	1.12	0.56	0.91	1.73
July	0.61	0.53	0.52	.79
August	1.11	0.31	0.60	1.03
September	0.85	0.45	0.42	.89
October	1.67	0.58	0.47	.94
November	1.99	1.35	1.11	.83
December	1.17	1.62	1.18	1.88

INCHES ON DRAINAGE AREA.

MONTH.	1898.	1899.	1900.	1901.
January	2.08	1.64	1.50	.79
February	1.39	1.18	2.88	.67
March	5.02	2.38	1.98	2.00
April	3.23	6.12	5.60	7.03
May	2.69	2.43	2.30	2.99
June	1.25	0.62	1.01	1.93
July	0.70	0.61	0.60	.91
August	1.28	0.35	0.69	1.18
September	0.95	0.50	0.47	1.00
October	1.92	0.66	0.54	1.08
November	2.22	1.56	1.24	.92
December	1.35	1.86	1.36	2.16
Total	24.08	19.91	20.17	22.66

DRAINAGE TRIBUTARY TO LOWER HUDSON RIVER AND LONG ISLAND SOUND.

KINDERHOOK CREEK AT EAST NASSAU AND WILSON'S DAM, RENSSELAER COUNTY, N. Y.

Gaugings of this stream were conducted by the Albany Water Department during the years 1892, 1893 and 1894, the results of which are of interest in connection with measurements of surrounding watersheds like Ten-Mile, Housatonic and Fishkill, proposed possible sources of municipal supply for New York city.

The original Kinderhook gaugings have been furnished for calculation by George I. Bailey, Superintendent of the Albany Bureau of Water.

Kinderhook Creek is an interstate stream having its source in Hancock Mountains, Massachusetts. It flows in a southwesterly direction through Rensselaer and Columbia Counties, N. Y., debouching into Hudson River at Stockport. Its tributary drainage is divided between New York and Massachusetts, as follows:

Drainage in New York....................	304.7 square miles
Drainage in Massachusetts................	29.3 square miles
Total drainage above mouth..........	334.0 square miles

A gauging record was kept at a weir erected across the stream above East Nassau, July 28 to November 30 inclusive, 1892. The record included the flow over the thin-edged weir or dam and the flow in the tailrace of the adjoining mill. Readings of the gauge height at both dam and race were taken at 30-minute intervals, from 6.30 p. m. to 7 a. m. each day, and the flows for the several one-half hour periods were summated to obtain the total yield during the night.

The measurements in the main stream were taken at a compound weir consisting of a lower central section 50.17 feet in length, over which the entire flow passed at ordinary stages of the stream; the remainder of the dam, having a length of 92.33

feet, was raised and leveled by means of a 2-inch plank to an elevation 1.20 feet above the central thin plate weir. Whenever the head exceeded 1.2 feet on the lower section, the water flowed over the entire dam 142.5 feet in length. The discharge has been computed by means of the Francis formula, allowing for two complete end contractions for all depths on the lower section.

The drainage area above the East Nassau gauging station is 120.5 square miles.

A second gauging station was established on Kinderhook Creek at Wilson's mill below Garfield Reservoir July 14, 1893, and a record maintained from that date until December 31, 1894.

The drainage area above the weir at Wilson's Dam is 68.2 square miles or 57 per cent. of that at East Nassau. Readings were taken at this weir at 6 a. m., 12 m. and 6 p. m., of each day.

The principal dimensions of the weir, which was of the compound variety, were as follows:

Total length of dam	92.22 feet
Length of central lower overflow	25.00 feet
Length of right overflow of main dam	37.95 feet
Length of left overflow, main dam	36.27 feet
Total length of upper overflow	74.22 feet
Difference of elevation of two spillways July 1, to May 25, 1894	1.0 foot
Difference of elevation of two spillways May 27, to December 31, 1894	0.89 foot

The accompanying tables show the mean daily flow in second-feet at the two Kinderhook stations for the periods during which the records were kept. The summary for Wilson's Dam includes the rainfall on the watershed from a private record kept at that station in 1894.

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
January 1907	[illegible]	41.2	87.3	1.28	1.38	2.14	[illegible]
February 1907	[illegible]	[illegible]	62.4	0.62	0.65	1.38	[illegible]
March	[illegible]	45.3	[illegible]	2.94	3.38	0.53	[illegible]
April	[illegible]	[illegible]	[illegible]	1.34	1.46	1.23	[illegible]
May	[illegible]	20.2	[illegible]	0.49	1.01	4.35	[illegible]
June	[illegible]	16.2	45.7	[illegible]	0.82	2.40	[illegible]
July	[illegible]	[illegible]	17.5	0.26	0.30	3.33	[illegible]
August	[illegible]	5.2	8.9	0.13	0.15	0.70	[illegible]
September	54.6	4.1	14.5	0.21	0.34	3.15	[illegible]
October	[illegible]	9.3	[illegible]	0.41	0.47	4.14	[illegible]
November	164.6	46.5	[illegible]	1.31	1.47	2.40	[illegible]
December	451.1	44.0	[illegible]	1.83	2.13	2.51	[illegible]
Year	....	....	....	....	13.97	27.90	[illegible]

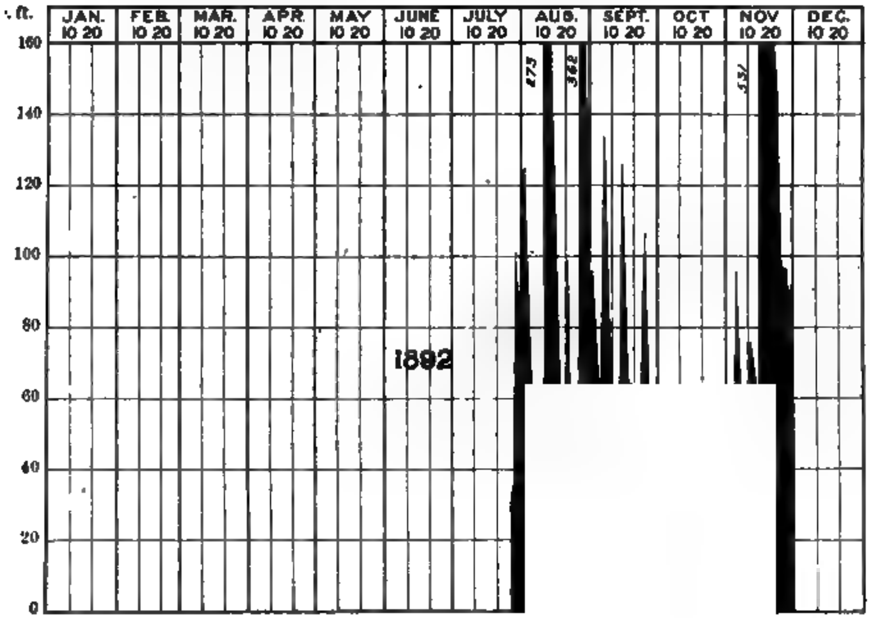

Fig. No. 105.—Discharge of Kinderhook Creek at East Nassau, Rensselaer County, N. Y., 1892.

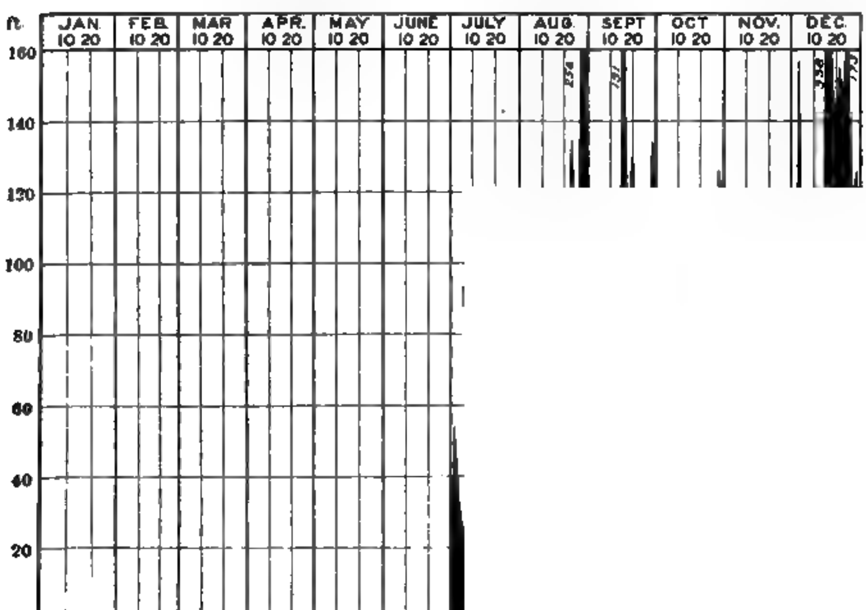

Fig. No. 106.—Discharge of Kinderhook Creek at Wilson's Dam, Rensselaer County, N. Y., 1893.

Mean Daily Flow in Second-feet of Kinderhook Creek at East Nassau, N. Y.

[Drainage area, 120 square miles.]

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1892.												
1	......	......	......	......	......	......	......	125.39	96.72	31.63	31.93	......
2	......	......	......	......	......	......	......	86.78	83.39	30.54	30.07	......
3	......	......	......	......	......	......	......	69.42	69.44	31.62	40.61	......
4	......	......	......	......	......	......	......	59.90	63.39	31.98	51.93	......
5	......	......	......	......	......	......	......	53.35	58.12	32.55	95.79	......
6	......	......	......	......	......	......	......	47.11	134.69	44.02	65.41	......
7	......	......	......	......	......	......	......	46.96	102.92	43.71	52.08	......
8	......	......	......	......	......	......	......	40.40	76.72	34.25	51.15	......
9	......	......	......	......	......	......	......	37.28	61.69	41.38	47.74	......
10	......	......	......	......	......	......	......	61.15	58.12	33.79	59.83	......
11	......	......	......	......	......	......	......	81.74	51.61	31.46	76.10	......
12	......	......	......	......	......	......	......	273.54	44.48	35.18	72.07	......
13	......	......	......	......	......	......	......	159.68	39.22	36.27	65.87	......
14	......	......	......	......	......	......	......	110.67	111.14	36.12	61.69	......
15	......	......	......	......	......	......	......	78.95	126.82	36.12	58.12	......
16	......	......	......	......	......	......	......	66.03	76.88	38.28	221.25	......
17	......	......	......	......	......	......	......	56.78	67.89	37.97	531.48	......
18	......	......	......	......	......	......	......	47.27	63.08	38.59	281.40	......
19	......	......	......	......	......	......	......	50.37	52.23	38.13	329.28	......
20	......	......	......	......	......	......	......	39.59	44.33	42.78	238.42	......
21	......	......	......	......	......	......	......	46.65	......	38.13	189.39	......
22	......	......	......	......	......	......	......	45.10	48.05	34.56	166.73	......
23	......	......	......	......	......	......	......	44.33	40.30	33.63	144.77	......
24	......	......	......	......	......	......	......	39.99	92.38	32.24	119.04	......
25	......	......	......	......	......	......	......	46.65	107.42	28.52	99.51	......
26	......	......	......	......	......	......	......	362.39	61.69	28.67	96.72	......
27	......	......	......	......	......	......	......	294.76	49.14	30.38	97.34	......
28	......	......	......	......	......	......	82.24	187.75	39.23	30.85	88.19	......
29	......	......	......	......	......	......	37.20	142.60	35.08	30.23	90.67	......
30	......	......	......	......	......	......	101.37	99.51	36.58	31.62	91.76	......
31	......	......	......	......	......	......	84.94	96.72	......	30.85	......	......
Mean	......	......	......	......	......	......	68.90	97.80	68.70	34.70	121.50	......

Mean Daily Flow in Second-feet of Kinderhook Creek at Wilson's Dam, N. Y.

[Drainage area, 68 square miles.]

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1893.												
1	......	......	......	......	......	......	33.0	15.2	60.9	90.7	73.2	68.8
2	......	......	......	......	......	......	53.8	13.0	47.4	71.5	64.9	56.6
3	......	......	......	......	......	......	36.1	12.8	38.4	60.0	68.5	67.1
4	......	......	......	......	......	......	31.8	11.2	35.7	56.0	73.8	158.1
5	......	......	......	......	......	......	29.9	10.9	31.5	53.6	73.9	101.4
6	......	......	......	......	......	......	25.9	10.2	27.7	49.9	65.9	97.5
7	......	......	......	......	......	......	22.0	30.0	38.1	66.8	60.3	93.2
8	......	......	......	......	......	......	26.5	50.7	31.7	63.1	58.7	80.1
9	......	......	......	......	......	......	36.7	30.1	53.6	51.9	54.6	80.0
10	......	......	......	......	......	......	27.0	19.5	37.7	47.3	50.7	81.2
11	......	......	......	......	......	......	22.0	14.5	31.9	55.5	47.4	67.7
12	......	......	......	......	......	......	27.6	13.4	28.1	50.2	46.2	63.6
13	......	......	......	......	......	......	47.9	11.2	26.0	61.7	46.0	47.0
14	......	......	......	......	......	......	30.4	10.4	28.6	111.6	45.4	45.3
15	......	......	......	......	......	......	23.6	9.2	61.7	85.9	42.8	67.6
16	......	......	......	......	......	......	21.1	8.8	191.2	66.2	42.2	211.2
17	......	......	......	......	......	......	19.8	9.2	156.8	58.0	43.2	338.7
18	......	......	......	......	......	......	20.3	11.8	103.1	50.1	45.1	241.4
19	......	......	......	......	......	......	17.2	11.1	109.7	47.1	47.1	165.6
20	......	......	......	......	......	......	15.1	13.6	128.8	44.8	43.6	110.8
21	......	......	......	......	......	......	12.5	12.2	87.9	32.4	42.3	127.7
22	......	......	......	......	......	......	13.5	10.3	70.4	30.2	51.3	155.0
23	......	......	......	......	......	......	13.9	9.1	63.9	46.3	54.7	149.4
24	......	......	......	......	......	......	13.0	32.6	57.5	66.8	47.3	147.9
25	......	......	......	......	......	......	11.8	133.9	61.4	58.9	41.2	171.9
26	......	......	......	......	......	......	21.2	94.1	68.4	51.3	32.4	172.6
27	......	......	......	......	......	......	40.0	64.3	56.4	55.2	42.2	136.3
28	......	......	......	......	......	......	24.6	154.1	50.1	126.6	89.0	119.2
29	......	......	......	......	......	......	20.0	[illegible]	184.4	120.3	93.2	123.8
30	......	......	......	......	......	......	19.7	167.2	128.5	96.6	78.6	126.2
31	......	......	......	......	......	......	16.7	88.7	......	83.9	......	96.3
Mean	......	......	......	......	......	......	25.0	44.8	69.8	64.8	55.5	121.7

Mean Daily Flow in Second-feet of Kinderhook Creek at Wilson's Dam, N. Y.—(Concluded).

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1894.												
1	76.9	66.0	40.9	93.9	67.4	98.9	15.5	18.8	5.5	9.3	73.8	57.3
2	77.2	59.5	49.6	83.2	61.2	96.7	14.1	12.0	4.1	9.9	51.9	56.0
3	81 8	63.2	66.2	78.2	57.8	90 8	17.2	12.9	6 6	15.7	134.1	51 5
4	88.5	58.0	96 6	87.1	58.1	80.8	18.9	16 6	6.7	35.0	164.5	53.9
5	115.5	45.0	156.5	101.2	63.2	67.3	17.8	14 5	7.2	34.7	130.5	57.5
6	113.9	45.1	315 9	88.2	62.9	60.8	25.9	13.0	6 1	29 1	159.8	48.4
7	91.9	47.6	608.9	90.1	87.7	55.6	48.8	9.1	6.1	23.6	124.1	49 8
8	84.3	49.8	457.1	82.2	74.9	58.3	29.9	8.1	6.6	18 0	104.2	45.9
9	77.0	49.8	343.4	84.9	56.7	51.0	23.1	9.6	8.9	18.4	96 0	44.3
10	71.0	47.6	305.4	86.4	48.2	43.2	17.4	8.9	13.1	39.5	95.9	48 2
11	71.1	45.6	325.6	78.4	47.1	39.8	14.3	8.4	17.2	68 5	90.7	48.7
12	53 3	36.9	330.4	76.4	48 2	37 5	17.4	7.9	13.1	49.0	75.6	288.2
13	44 8	33.0	267.9	76.9	40.8	32.6	14.8	8.3	10.6	43.7	65.4	452.0
14	67.7	45.0	232.3	76.3	38.0	34.4	13.2	8.0	12.4	41.5	66.7	270.7
15	78 6	43.1	189.0	70.1	37.4	26.5	13.7	9.9	14 9	44.8	65.7	189 3
16	160 6	39.1	160.6	64 3	34.4	25.9	13 4	11.3	15.2	34.9	83.1	169.4
17	138.3	39 7	150.7	61.2	30.8	23.4	12.6	9.4	23.5	29.1	104 8	185 9
18	79.2	55.7	155.7	59.1	36 3	23.9	12.1	7.8	19.8	26.2	100 3	163.4
19	81.2	74.1	190.4	58.9	46 8	40.9	10.8	6.8	20 0	26.0	85.6	135 8
20	66.0	63.9	204.4	68 8	40 8	78.7	10.7	8.2	54.6	21.7	75.8	123 4
21	78.7	52.7	167.7	123 8	33.6	67.0	12.3	8 2	37.5	19.1	66.5	111.9
22	72.9	44 6	163.9	129.6	31.6	51.8	22.6	8.5	24.2	19.2	64.5	109 4
23	62.6	40.8	234.6	151.6	37.4	36.1	17.7	5 8	16 6	19.4	65.6	87.0
24	73.0	33.5	220.8	143.8	63.4	27 1	13.1	7.2	16.1	20.6	96.4	70 4
25	129.6	37.8	175.6	123.5	81.2	22 9	13 0	6.1	14 7	23.7	95.3	78 6
26	88.7	36 1	144.5	105 7	72.4	22.0	10.5	5.4	12.4	28.4	83 6	57 8
27	83.5	33.3	107.6	91.8	58 8	22.9	10.1	5.3	11.7	25 9	77 7	38 3
28	68.8	35.0	91.3	84.5	70 4	22.2	8.7	5.7	11.2	22.2	65.9	48 4
29	59.1	......	88.8	78 3	160.8	19.1	14.5	5.4	10.1	19.1	46 5	51 8
30	60.1	......	83.4	78.8	112.4	16.3	36.0	5.7	9.1	16.6	51.5	52 9
31	64.5	......	84.0	......	98.9	......	21.1	7.0	......	40.9	......	54 7
Mean	81.8	42.6	200.3	88.7	60.0	45.7	17.5	8.9	14.5	28.2	88.9	125 3

NORMANSKILL AT FRENCH'S MILL, ALBANY COUNTY, N. Y.

The Normanskill drains an area of 168 square miles, lying between the lower Mohawk watershed and the northern drainage slope of the Catskill Mountains, and including a portion of the counties of Albany and Schenectady. The stream enters tide water of Hudson River at Kenwood, a suburb of Albany. A gauging record, showing the flow of this stream from June 1 to December 1, 1891, is of interest in connection with measurements of flow from the adjacent Catskill and Schoharie watersheds, proposed as possible sources of supply for Greater New York. The volume of flow was determined by means of weirs erected at French's Mill, by the Bureau of Water of Albany. Mr. George I. Bailey, Superintendent of the Bureau, has furnished the original records for computation. The stream is at an elevation of 200 feet above tide at the point where gauged,

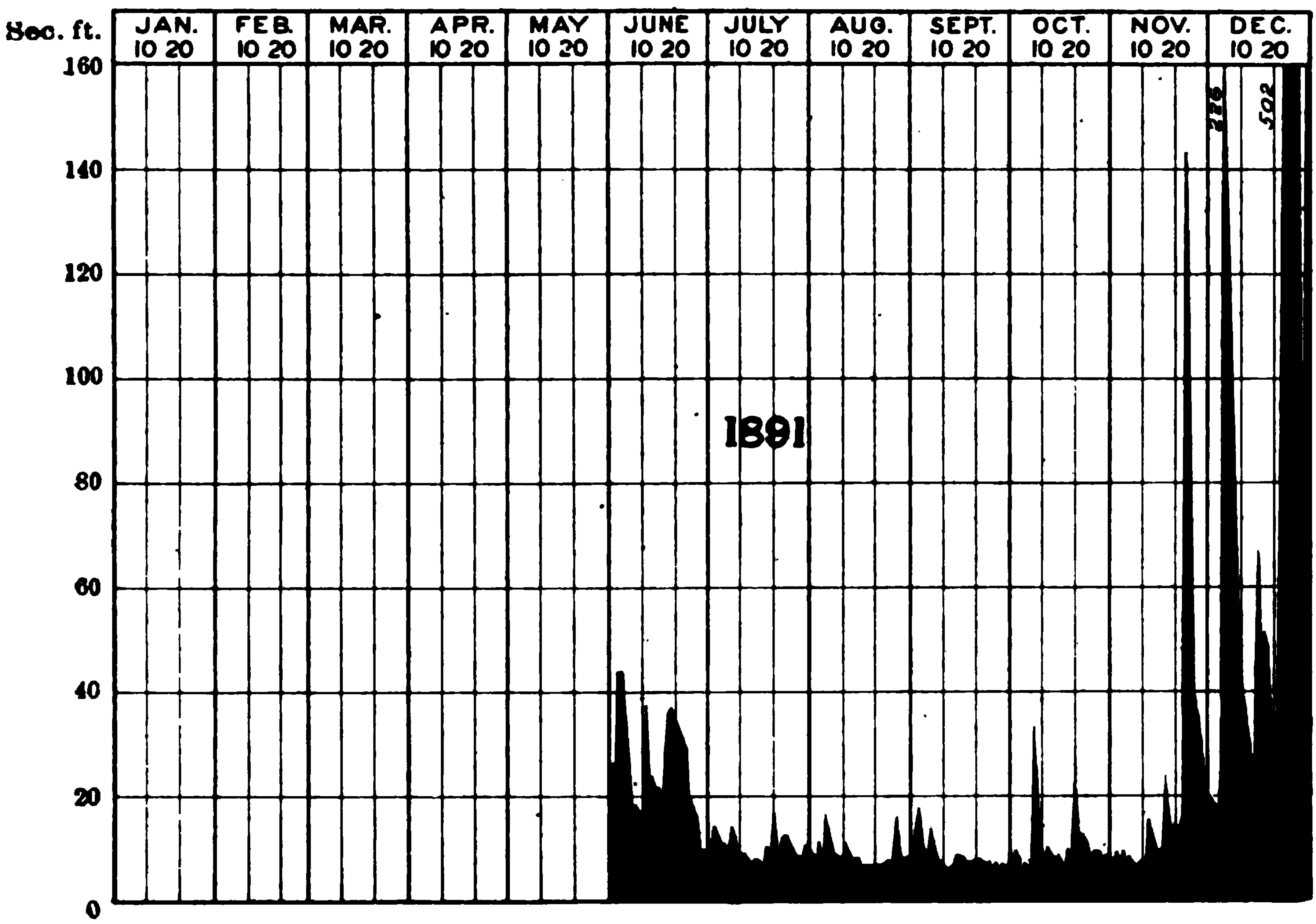

Fig. No. 107.—Discharge of Normans Kill at French's Mills, Albany County, N. Y., 1891.

and receives the drainage from an area of 110.6 square miles or 66 per cent. of the entire watershed.

Below French's Mill the stream follows a tortuous valley relatively deep and narrow, its banks rising abruptly from the flood plain. The topography of the lower Normanskill is shown on the Albany sheet of the Geological Survey Map.

Mean Daily Flow in Second-feet of Normanskill at French's Mill, Albany County, N. Y.

[Drainage area, 111 square miles.]

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.
1891.												
1	......	......	......	......	......	25.57	10.88	8.84	8.24	8 99	7.98	20.15
2	......	......	......	......	......	20 31	14 52	8.53	18.44	10.09	9 84	18.91
3	......	......	......	......	......	44.64	12.76	12.71	12.23	7.78	7 98	17.98
4	......	......	......	......	......	41.64	11.89	8.74	9 39	4 87	9.68	24 49
5	......	......	......	......	......	44.64	11.89	16.89	9.14	7.94	8.14	226.90
6	......	......	......	......	......	31.46	10.88	11.98	14.15	7 07	9.04	119.51
7	......	......	......	......	......	24.18	10.07	9.08	9.96	6.71	8 00	95.02
8	......	......	......	......	......	18.44	14.52	8.89	8 52	34.10	6.97	73.62
9	......	......	......	......	......	18.29	11.95	8.52	7.57	15.08	8.42	51.15
10	......	......	......	......	......	17.21	9.30	8.84	7.22	9.93	10.31	49.44
11	......	......	......	......	......	18.29	9.30	8.25	6.22	8.84	8.14	44.02
12	......	......	......	......	......	37.82	8 99	10.86	6.49	10.58	16.69	39.83
13	......	......	......	......	......	23.87	8.09	8.77	6.77	8.68	14.21	29.61
14	......	......	......	......	......	24.18	7.50	7.93	9.14	9 47	13.03	27.43
15	......	......	......	......	......	22.16	8.09	7.65	7.66	8.46	9.84	26.66
16	......	......	......	......	......	22.82	7.78	7.93	7 05	9.80	10.63	67.27
17	......	......	......	......	......	17.21	7.50	7.21	7.05	8.09	11.46	47.89
18	......	......	......	......	......	33 48	7.85	7.21	7.50	6.09	25.27	51.60
19	......	......	......	......	......	35.96	10.65	7.21	7.50	10.24	16.22	49.60
20	......	......	......	......	......	37.51	9.15	6.65	6.22	8.84	14.43	37.97
21	......	......	......	......	......	35.84	18.29	6.77	7.15	23.41	15.83	32.71
22	......	......	......	......	......	33.48	9.93	6 49	6.09	12.07	18 71	31.77
23	......	......	......	......	......	31.46	9.55	6.22	7.07	13.09	18.09	137.17
24	......	......	......	......	......	29.45	11.83	6 62	6.49	11.57	142.89	479.49
25	......	......	......	......	......	20 92	11.16	7.24	7.05	9.14	75.81	502.54
26	......	......	......	......	......	19.68	10.74	5.94	7.66	9.93	46.83	391.84
27	......	......	......	......	......	18.29	9.15	9.26	5.88	10.09	40.09	279.12
28	......	......	......	......	......	16.27	7.94	16.12	5.55	9.62	85.41	129.27
29	......	......	......	......	......	10 38	8 25	8.96	4.65	8.68	22.71	70.58
30	......	......	......	......	......	10.07	8.09	7.93	6.77	9.14	18.72	858.76
31	......	......	......	......	......	......	10.46	8.87	......	9.80	......	......
Mean	......	......	......	......	......	26.2	10.2	8.7	8.1	10.6	21.7	57.2

Mean Monthly Run-off of Normanskill at French's Mill, Albany County, N. Y.

[Drainage area, 111 square miles.]

DATE.	Maximum, second-feet	Minimum, second-feet.	Mean, second-feet.	Mean, sec. ft. per sq mile.	Run-off, inches, on drainage area.
1891.					
June	44.6	10.1	26.2	0.24	0.27
July	18.1	7.8	10.2	0.09	0.10
August	16.7	5.9	8.7	0.08	0.09
September	18.4	4 6	8.1	0.07	0.08
October	34.1	4 9	10.6	0.10	0 11
November	142.0	6 9	21 7	0.20	0.22
December	84.3	18.0	57.2	0.51	0.59

GAUGINGS OF STREAMS PROPOSED AS SOURCES OF PUBLIC WATER SUPPLY FOR NEW YORK CITY.

Through the co-operation of the Department of Water Supply of New York, George W. Birdsall, Chief Engineer, a series of gaugings of streams which have been proposed as possible sources of future municipal water supply for Greater New York have been undertaken. The gaugings include streams draining for the most part timber covered mountainous areas in southeastern New York State, on both the Catskill and Connecticut sides of Hudson River.

In June, 1901, a reconnaissance was made of Catskill and Esopus Creek, Wallkill River and Rondout Creek, west of the Hudson; and Fishkill Creek and Ten Mile River, east of the Hudson. Nearly the entire length of each stream was traversed and a site for a gauging station selected on each. Early in July the stations were established, with the exception of that on Ten Mile River. Persons living near at hand were employed as gauge readers to take observations of the stage of the stream twice each day.

One object of the gaugings has been to determine the available run-off for storage of the several streams, at sites selected for storage reservoirs.[a] It was not practicable in most cases to locate a gauging station precisely at the foot of the watershed tributary to the proposed reservoir. The relation between the estimated drainage area at the reservoir sites and at the gauging station on each stream is shown below:

STREAM.	Location of gauging station.	Drainage Area in Sq. Miles.		
		Above proposed reservoir.	Above gauging station.	Above mouth.
Ten Mile River	Dover Plains, N. Y.	200	195	195
Housatonic River	Gaylordsville, Conn	1,020	1,020	1,580
Catskill Creek	South Cairo, N. Y	140	280	384
Esopus Creek	Kingston, N. Y	242	312	417
Wallkill River	New Paltz, N. Y	464	736	770
Rondout Creek	Rosendale, N. Y	181	385	386[b]
Fishkill Creek	Glenham, N. Y	158	198	204

a These reservoirs are described in the Report on New York's Water Supply, by John R Freeman.

b Above junction with Wallkill River.

The gaugings at each of the stations referred to in the table are made by means of the current meter; the discharge measurements having mostly been made by field assistants A. E. Place and W. W. Schlecht. Velocity observations are taken at horizontal intervals of five feet across the entire width of the channel, the current meter being submerged 0.6 depth of the sounding at each 5 foot station. In order to determine whether the velocity so obtained is the true mean velocity desired, observations of velocities in vertical planes have been taken at intervals of 0.5 foot of depth from surface to bottom. At a number of the stations the stream-bed consists of rock strata overlaid with inwashed sand or gravel. The vertical velocity observations are repeated from time to time to determine whether these deposits have shifted in position in such a way as to sensibly affect the rating curve of the cross sections. During the winter similar vertical velocity curves will be obtained to determine the effect of the increased wetted perimeter due to ice covering the stream.

Wallkill, Housatonic, and Ten Mile Rivers are interstate streams. The first receives tributary drainage from New York, but does not itself flow through New York State. Ten Mile River lies mostly in New York, though the lower few miles of its course and its mouth are in Connecticut. Wallkill River has its headwaters in New Jersey, but most of its channel and watershed, as well as its outlet, are in New York.

The results of gaugings at a station on Housatonic River, established in 1900 by the United States Geological Survey, and of gaugings of Croton River by the Department of Water Supply of New York, have been included in this division of the report.

CATSKILL CREEK AT SOUTH CAIRO, GREENE COUNTY, N. Y.

The drainage basin of this stream receives the run-off from the north slope of the Catskill Range, and lies, for the most part, in the timbered highlands of Greene County. Its source

is in a swamp at Franklinton, the opposite side of which drains into Schoharie Creek. The stream enters tide water of Hudson River at Catskill. The lowest two miles of its course, below the influx of Kaaterskill Creek, being slack water. From Kaaterskill Creek, to Leeds, a distance of three miles, it flows through a gorge formed of tilted strata of bluestone, affording within this distance a fall of 180 feet. The topography of the watershed is shown on the Durham, Coxsackie, and Catskill Atlas Sheets of the United States Geological Survey. The stream flows over a rock bed through much of its course. The slopes of the drainage basin are precipitous and there are no lakes, and little artificial storage. The stream is subject to wide variations in flow. High water marks observed at the Woodstock Dam, indicate a freshet discharge in the spring of 1901, of 21,000 second-feet, or 100 second-feet per square mile from the tributary drainage area of 210 square miles.

The principal tributary of Catskill Creek, above the station at South Cairo, is Basic Creek, entering at Freehold. The reported high water mark on the dam at Freehold indicates a maximum freshet discharge for Basic Creek of 3,330 second-feet or 81 second-feet per square mile from the tributary drainage area of 41 square miles.

The gauging station is located at the highway bridge in the Village of South Cairo, and was established July, 1901. A 15-foot boxed weight gauge divided to feet and tenths was fastened to cross pieces on horizontal chords of the second section of bridge from the right bank, downstream side. The total span of the bridge is 194.5 feet between abutments, the faces of which are vertical. The stream-bed is of earth for twenty-five feet from the right-hand abutment. At this point a bluestone rock ledge outcrops, covered in patches with loose shingle and shifting gravel. The bench mark is on "O" near outer corner, upstream side of bridge seat, on right hand abutment.

Elevation of bench mark..........................	100.00
Elevation water surface when gauge reads zero....	78.71
Center of highway 50 feet to left of end of bridge....	97.11

The entire flow of the stream at all stages passes under this bridge. High water marks observed at the bridge indicate a maximum elevation of the water surface of 96.2 feet, equivalent to a gauge reading 17.5 feet. The stage of the stream is observed each morning and evening by the gauge reader Mr. C. F. Abrams. The following table shows the results of discharge measurements which have been made. During extreme low water the current meter measurements are made by wading at a point 400 feet below the gauging station.

Table Showing Principal Developed Water Powers on Catskill Creek in 1901.

Number of dams.	LOCATION.	Name of mill and of owner or operator.	Business or class of manufacture.	WORKING HEAD ON WATER WHEELS, IN FEET. Greatest.	Least.	Average.	Water privilege at dam.	Rated power of water wheels at usual head, H. P.	H. P. of engines.	Remarks.
1	Leeds	Catskill Woolen Mill	Woolen and cotton fabrics	26	12	18	Entire	200	60	Mill not operated.
2	Leeds	ll	Woolen and cotton fabrics.	19	4	14	Entire	200	60	Mill not operated.
3	Lake's Mills		Grist mill				Entire			
4	Woodstock		Paper mill	24	10		Entire			[illegible]
1	Freehold	[illegible]	Grist mill	13	10	11	Entire	15–30	None.	[illegible], Catskill at Freehold.
2	Greenville	Reed's Mills	Grist mill			22	Entire	22	6	[illegible], Catskill at Freehold.
1	East Durham	Not reported	Grist mill			16	Entire			Abandoned, Glenbrook stream.
2	East Durham	Atter Bros.	Saw and feed mill	30			Entire	30		Glenbrook stream.
3	East Durham					10	Entire			Abandoned, Glenbrook stream.

Daily Gauge Height of Catskill Creek at South Cairo, Greene County, N. Y.

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept	Oct.	Nov.	Dec.
1901.												
1	......	......	......	......	......	......	......	2.55	2.92½	2.8	2.7	2.65
2	......	......	......	......	......	......	......	2.6	3.0	2.75	2.7	2.65
3	......	......	......	......	......	......	......	2.55	3.32½	2.7	2.65	2.65
4	......	......	......	......	......	......	2.75	2.4	3.27½	2.7	2.67½	3.3
5	......	......	......	......	......	......	2.9	2.4	3.05	2.67½	2.67½	3.3
6	......	......	......	......	......	......	3.3	2.5	2.97½	2.67½	2.65	3.32
7	......	......	......	......	......	......	3.6	3.35	2.87½	2.62½	2.7	3.32
8	......	......	......	......	......	......	3.63	3.05	2.9	2.65	2.7	3.3
9	......	......	......	......	......	......	3.85	2.87½	2.87½	2.6	2.65	3.85
10	......	......	......	......	......	......	3.075	2.8	2.82½	2.65	2.65	5.35
11	......	......	......	......	......	......	3.53	2.77½	2.8	2.6	2.65	4.62
12	......	......	......	......	......	......	3.45	2.65	2.75	2.6	2.67½	4.45
13	......	......	......	......	......	......	3.23	2.55	2.77½	2.65	2.8	3.95
14	......	......	......	......	......	......	3.0	2.5	2.72½	2.8	3.02	6.95
15	......	......	......	......	......	......	2.85	2.5	2.7	3.1	2.85	12.8
16	......	......	......	......	......	......	2.9	2.5	2.75	3.15	2.82	5.6
17	......	......	......	......	......	......	3.85	2.4	2.82½	3.02½	2.77	5.0
18	......	......	......	......	......	......	3.78	2.52½	2.97½	2.97½	2.75	4.4
19	......	......	......	......	......	......	4.85	2.62½	2.97½	2.9	2.75	4.0
20	......	......	......	......	......	......	3.58	2.67½	2.82½	2.85	2.75	3.85
21	......	......	......	......	......	......	3.17½	2.75	2.8	2.82½	2.75	3.9
22	......	......	......	......	......	......	2.67½	3.05	2.8	2.8	2.75	4.0
23	......	......	......	......	......	......	2.95	3.22½	2.77½	2.8	2.7	4.0
24	......	......	......	......	......	......	3.0	3.45	2.72½	2.8	2.7	4.07
25	......	......	......	......	......	......	3.02½	3.55	2.67½	2.8	2.7	3.45
26	......	......	......	......	......	......	2.82½	3.2	2.65	2.8	2.7	3.4
27	......	......	......	......	......	......	2.7	2.95	2.65	2.75	2.65	3.4
28	......	......	......	......	......	......	2.7	2.8	2.7	2.75	2.65	3.5
29	......	......	......	......	......	......	2.72½	2.7	2.8	2.75	2.65	3.85
30	......	......	......	......	......	......	2.65	2.65	2.82½	2.7	2.65	4.5
31	......	......	......	......	......	......	2.6	2.6	......	2.7	......	4.4

Current Meter Discharge Measurements of Catskill Creek at South Cairo, Greene County, N. Y.

DATE.	Mean gauge height, feet.	Discharge, second-feet.	Hydrographer.
1901.			
October 10	2.58	23.3	Hollister and Schlecht.
October 4	2.70	25.6	W. W. Schlecht.
November 8	2.70	27.6	W. W. Schlecht.
August 19	2.70	39.6	Hollister and Place.
September 23	2.74	35.6	W. W. Schlecht.
November 9	2.75	42.3	W. W. Schlecht.
July 4	2.75	60.9	Horton and Hollister.
August 1	2.80	47.9	A. E. Place.
October 22	2.82	54.2	W. W. Schlecht.
September 7	2.92	68.8	A. E. Place.
August 9	3.00	81.5	A. E. Place.
July 25	3.00	81.9	A. E. Place.
September 2	3.00	87.0	A. E. Place.
August 27	3.12	121.4	A. E. Place.
July 17	3.50	260.3	Pressey and Place.
July 20	3.60	307.5	A. E. Place.

A gauging station was made through ice 0.2 to 0.7 feet thick at a point 200 feet below the highway bridge by W. W. Schlecht, December 9, 1901.

Gauge height.. 3.30

Discharge, second-feet............................ 109.5

ESOPUS CREEK AT KINGSTON, ULSTER COUNTY, N. Y.

Esopus Creek has its source in Winnisook Lake on the northwestern slope of Slide Mountain, the highest peak of the Catskills.

From Big Indian to Olive Bridge, the stream flows through a deep valley, flanked on both sides by timber-covered mountains. Numerous sites for dams or storage reservoirs are offered at points where the valley broadens out for a short distance to receive the inflowing waters of tributaries. The most notable are at Big Indian, where Birch Creek enters; at the mouth of Bush Kill, at Shandaken; at the mouth of Stony Clove Creek, at Phoenicia; at Cold Brook, where Little Beaver Kill enters; and at Olive Bridge. The stream channel is relatively broad and shallow. The bed is covered with cobble and small boulders left behind after the erosion of drift deposits which formerly filled the valley. The descent of the stream is rapid though not precipitous until Olive Bridge is reached. At this point, the stream flows over a rock ledge in a narrow gorge forming Bishop's Falls. The natural fall is 22 feet and is increased to 28 feet by a timber dam on the crest of the ledge. This dam was originally constructed in 1828. High-water marks at Olive Bridge, just below the falls, indicate that the stream is subject to fluctuations of stage of 30 feet or more in a gorge 100 feet wide. Below Bishop's Falls the stream flows through a narrow gorge for some distance, after which the valley broadens out and the slopes become more gentle.

At Kingston the stream turns northward and flows parallel to Hudson River to Saugerties. A second notable water fall occurs at Glen Erie, where a short cascade occurs involving a fall of 36 feet. The final descent to tide water at Saugerties is made through a fall of 42 feet.

The gauging station was established at Washington Avenue Bridge in Kingston July 5, 1901. This bridge has a clear span of 116.6 feet between abutments, which are nearly vertical. In addition, there is on the left-hand side an overflow channel 19 feet

Fig. No. 108.—Esopus Creek: Bishop's Falls and Olivebridge, Ulster County, N. Y.

in width. A boxed weight gauge, reading from zero to 15 feet, with the scale graduated to tenths of feet, was secured to the horizontal bridge chords on the upstream side near the left-hand end of the bridge. Gauge readings are taken each morning and evening. The observer is John Douglas. A circular chisel draft cut in the corner of the coping of the right-hand abutment forms the bench mark.

Elevation of bench mark..........................	100.00
Elevation of water surface when gauge reads zero....	68.27

Owing to unfavorable conditions at the bridge, gaugings during extreme low water and during freshets are made, the former by wading at a point near the bridge, and the latter at the Ulster & Delaware R. R. Bridge, one-fourth mile upstream. The maximum stage of the stream corresponds to a gauge reading of nearly 25 feet. December 15, 1901, the stream attained a maximum gauge reading of 22.75 feet.

Current Meter Discharge Measurements of Esopus Creek at Kingston, Ulster County, N. Y.

DATE.	Gauge height, feet.	Discharge, second-feet.	Hydrographer.
1901.			
August 5	3.60	39.9	A. E. Place.
July 22	3.80	64.2	A. E. Place.
July 18	4.10	144.9	A. E. Place.
July 5	4.32	148.0	Horton and Hollister.
July 19	4.40	172.7	A. E. Place.
November 18	4.45	126.5	W. W. Schlecht.
September 26	4.55	167.8	W. W. Schlecht.
September 26	4.55	150.4	W. W. Schlecht.
August 19	4.60	180.2	Hollister and Place.
October 10	4.62	165.8	W. W. Schlecht.
October 10	4.62	188.1	George B. Hollister.
October 8	4.70	178.2	W. W. Schlecht.
November 1	4.74	184.3	W. W. Schlecht.
November 14	4.75	195.4	W. W. Schlecht.
September 21	4.78	200.3	W. W. Schlecht.
August 10	4.85	239.2	A. E. Place.
November 26	5.06	244.7	W. W. Schlecht.
October 3	5.26	329.4	W. W. Schlecht.
September 6	5.46	352.2	A. E. Place.
August 29	5.50	364.3	A. E. Place
October 21	5.56	380.8	W. W. Schlecht.
August 8	5.65	396.1	A. E. Place.
September 4	6.11	554.3	A. E. Place.
August 27	6.26	728.6	A. E. Place.
October 16	6.64	785.2	W. W. Schlecht.
December 19	8.35	1,472.0	W. W. Schlecht.
December 11	11.46	1,720.8	W. W. Schlecht. [a]
December 30	12.15	3,989.0	W. W. Schlecht.

[a] Backwater from ice dam 500 yards down stream.

Drainage Area of Esopus Creek.

LOCATION.	Square miles.
Above mouth at Saugerties	417
Above Glen Erie Falls	409
Above gauging station, Kingston	312
Above Bishop's Falls, Olive Bridge	234

A current meter measurement of Esopus Creek was made by E. G. Paul at Broadhead's Bridge, August 14, 1900. The discharge was 92 second-feet.

From a report of M. E. Evans, C. E., to the Saugerties Manufacturing Company in 1899, the following estimate of the mean flow of Esopus Creek at Saugerties during the several months of the driest year has been taken. The method of obtaining these results is not stated.

MONTH.	Flow in second-feet.	Flow in second-feet per square mile.
January	586	1.41
February	705	1.69
March	733	1.76
April	658	1.58
May	442	1.06
June	304	.73
July	98	.24
August	147	.35
September	152	.36
October	244	.58
November	456	1.09
December	489	1.17

Mr. Evans states that on December 10, 1878, occurred the highest known freshet in the stream. This resulted from a snowfall of six inches, followed by continuous excessive rains for three days, terminating in a downpour of unusual severity. The stream flowed in its highest stage 13 to 14.5 feet in depth over the crest of the dam 330 feet in length, indicating a flood discharge of from 50,000 to 60,000 second-feet, or from 120 to 145 second-feet per square mile.

Water is diverted from Sawkill Creek, a tributary of Esopus Creek, for the supply of Kingston. Sawkill Creek has its source

in Echo Lake, 2060 feet above tide, and flows southeasterly, entering Esopus Creek four miles below the city of Kingston. Its channel is very precipitous and numerous waterfalls occur. Two reservoirs have been constructed, the lower one at an elevation of 350 feet above tide. The amount of diversion varies from 1.5 to 3 second-feet.

Gaugings of Sawkill Creek by the late Wm. R. Hutton indicate the flashy and torrential character of the run-off from Esopus water-shed.[b] Mr. Hutton's measurements showed a minimum discharge of 1.5 second-feet at a point 1.5 miles above the mouth. In April, 1895, the melting of a twelve-inch fall of snow occasioned by warm winds and heavy rain, produced a flow of nearly 8,000 second-feet estimated discharge over the spillway of the lower reservoir. In 1896 it is estimated that a similar flood furnished over 8,000 second-feet. These extreme floods are of very short duration, the water remaining at its maximum stage not more than an hour or so. The drainage area above the point where the measurements were made is 35 square miles.

Estimated Extremes of Discharge of Sawkill Creek.

	Discharge.	
	Second-feet.	Second-feet Per square mile.
Minimum	1.25	.036
Maximum	8,000.	229.

Current Meter Discharge Measurements; Sawkill Creek, Four Miles Above Mouth.

DATE.	Discharge, second-feet.	Hydrographer.
September 30, 1901	53.5	W. W. Schlecht.
October 21, 1901	24	W. W. Schlecht.

b Water Supply and Irrigation Paper, U. S. Geol. Survey, No. 35, pp. 61-63.

Principal Developed Water Powers on Esopus Creek in 1901.

Number of dams.	LOCATION.	Name of mill and of owner or operator.	Business or class of manufacture.	Working head on water wheels, in feet. Greatest.	Least.	Average.	Water privilege of dam.	Rated power of water wheels.	H. P. of engines.	Remarks.
1	Saugerties		Tissue paper	40	30	36	Leased	607	485	Operated 24 hours per day.
2	Saugerties		Blank books	[illegible]	14	21	Leased	90	....	
3	Four miles above Saugerties		Grist mill	......	....	......		....	None	Idle since 1898.
4	Glen Erie		White lead	24	....	24	Entire	....	None	Right bank
5	Olive Bridge		Grist mill	18	....	20	½	....		Left bank, not operated.
6	Olive Bridge		Saw mill	[illegible]	....	[illegible]	½	....	None	
7	Brown station		Pulp mill	......	Good fall	......	Entire	....		
8	Boiceville		Excelsior	10	6	8	Entire	[illegible]	[illegible]	
9	Phoenicia		Excelsior	......	....	6	Entire	....		
10	Big Indian		Saw mill	......	....	10	Entire	40	None	
11	Pine Hill*	George Ross turning mill	Wood turning	......	....	10	Entire	....	None	

* On Birch Creek.

Fig. No 109.—Upper Hanging Rock Falls, Good Beer Kill, 2½ miles above Ellenville, Ulster County, N. Y. About 200 feet total fall.

Daily Gauge Height of Esopus Creek at Kingston, Ulster County, N. Y.

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.
1901.												
1	......	......	......	......	......	......	......	3.97½	6.47½	4.52½	4.62	4.6
2	......	......	......	......	......	......	......	3.95	6.3	4.62½	4.52	4.52
3	......	......	......	......	......	......	......	3.9	6.67½	4.7	4.85	4.77
4	......	......	......	......	......	......	......	4.95	6.27½	4.52½	4.87	5.45
5	......	......	......	......	......	......	4.3	3.95	5.8	4 42½	4.55	4.62
6	......	......	......	......	......	......	4.35	3.7	5.57½	4.3	4.47	4.67
7	......	......	......	......	......	......	4.3	3.95	5.42½	4.47½	4.57	4.72
8	......	......	......	......	......	......	4.4	7.0	5.0.½	4.57½	4.47	4.65
9	......	......	......	......	......	......	4.4	5.72½	5.17½	4.5	4.82	......
10	......	......	......	......	......	......	4.25	5.17½	4.95	4.52½	4.82	5.6
11	......	......	......	......	......	......	4.25	5.05	5.02½	4.47½	4.45	11.5
12	......	......	......	......	......	......	4.3	4.87½	4.87½	4.4	4.57	9.72
13	......	......	......	......	......	......	4.3	4.72½	4.9	4.5	4.6	7.85
14	......	......	......	......	......	......	4.2	4.6	4.87½	4.52½	4.45	8.12
15	......	......	......	......	......	......	3.95	4.42½	4.72½	4.57½	4.37	21.37
16	......	......	......	......	......	......	4.2	4.42½	4.75	4.65	4.43	15.2
17	......	......	......	......	......	......	4.05	4.37½	5.0	4.47½	4.3	10.55
18	......	......	......	......	......	......	4.05	4.55	5.27½	4.42½	4.37	9.05
19	......	......	......	......	......	......	4.6	4.5	5.07½	4.6	4.52	8.1
20	......	......	......	......	......	......	4.15	4.77½	5.35	4.77½	4.5	8.0
21	......	......	......	......	......	......	4.1	5.95	5.17½	4.77½	4.47	7.75
22	......	......	......	......	......	......	3.9	6.62½	4.77½	4.67½	4 52	7.2
23	......	......	......	......	......	......	4.05	5.92½	4.92½	4.67½	4.45	6.85
24	......	......	......	......	......	......	4.0	7.85	4.77½	4.62½	4.52	6.7
25	......	......	......	......	......	......	3.9	7.67½	4.5	4.62½	4.62	6.5
26	......	......	......	......	......	......	3.97½	6.52½	4.87½	4.52½	4.6	6.35
27	......	......	......	......	......	......	3.92½	6.02½	4.5	4.42½	4.57	6.25
28	......	......	......	......	......	......	3.85	5.87½	4.72½	4.45	4.77	6.0
29	......	......	......	......	......	......	3.72½	5.72½	4.45	4.57½	5.45	7.55
30	......	......	......	......	......	......	4.2	5.45	4.42½	4.47½	4.52	11.65
31	......	......	......	......	......	......	4.25	5.22½	......	4.6	......	9.45

RONDOUT CREEK AT ROSENDALE, ULSTER COUNTY, N. Y.

Rondout Creek has its source in the heart of the timber-covered mountain group forming Wittemberg Chain. It flows southeasterly to Napanoch, where it encounters the foot of Shawangunk Range, turns abruptly to the northeast and enters the Hudson River at Rondout. Its watershed on the south is very restricted, as it is separated from the Wallkill River only by the narrow Shawangunk Ridge. Notable waterfalls occur at Honk Falls and Napanoch over Hudson River shale, and on Good Beer Kill above Ellenville. On Good Beer Kill there is a total fall of 870 feet from the Cape, three miles above Ellenville, to Ellenville. Of this about 200 feet are concentrated in a series of cascades called Hanging Rock Falls.

Water power was originally developed at Napanoch in 1754. At present there are five dams in this village, utilizing a total of 115 feet fall. A series of cascades, involving a descent of about

50 feet, occurs at High Falls, where the water flows over Rosendale cement rock.

The gauging station was established at the highway bridge in Rosendale, three miles above the junction with the Wallkill, July 6, 1901. Readings of the river stage are taken each morning and evening by A. E. Huben. A 15-foot decimal scale in a wooden box, with weight and wire for observing the gauge height, is supported by outriggers fastened to the chords and floor-beams near the center of the downstream side of the bridge. The bridge has a single span of 136 feet. The bed of the channel is rock and the entire flow, aside from diversion to the Delaware and Hudson Canal, described elsewhere, passes under the bridge at all stages. The current is sluggish during extreme low water. Gaugings of low stages of the stream are made by wading at a ford one mile downstream. The bench mark is an "0" cut in the upstream corner of the bridge seat right-hand abutment.

Elevation bench mark..............................	100.00
Elevation water surface when gauge read zero.......	67.97

Drainage Areas of Rondout Creek.

LOCATION.	Square miles.
Above Honk Falls	66
Above High Falls	229
Above Gauging Station, Rosendale	265
Above Junction with Walkill River	269
Below Junction with Wallkill River	1,148
Above mouth at Rondout	1,164

Current Meter Discharge Measurements of Rondout Creek at Rosendale, Ulster County, N. Y.

DATE.	Gauge height, feet.	Discharge, second-feet.	Hydrographer.
1901.			
July 18	6.30	118.2	A. E. Place.
August 6	6.40	99.4	A. E. Place.
November 7	6.42	138.2	W. W. Schlecht.
September 24	6.45	159 6	W. W. Schlecht.
October 11	6.47	163.2	W. W. Schlecht.
October 11	6.47	201.8	G. B. Hollister.
November 16	6.55	183.0	W. W. Schlecht.
July 6	6.56	319.0	Horton and Hollister.
August 15	6.56	225 4	A. E. Place.
October 7	6.60	217.5	W. W. Schlecht.
September 7	6.90	426.7	A. E. Place.
August 20	6.94	526.4	Hollister and Place.
October 13	7.03	509.9	W. W. Schlecht.
August 28	7.15	644.6	A. E. Place.
August 8	7.50	745.4	A. E. Place.
September 4	7.56	836.1	A. E Place.
December 21	7.60	772.0	W. W Schlecht. *a*
September 3	7.80	1,200.0	A. E. Place.
December 12	8.00	1,490.8	W. W. Schlecht.
November 26	7.21	675.4	W. W. Schlecht.
December 30	11.95	5,358.0	W. W. Schlecht. *a*

a Stream somewhat obstructed by shore ice.

Daily Gauge Height of Rondout Creek at Rosendale, Ulster County, N. Y.

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug	Sept.	Oct.	Nov.	Dec.
1901.												
1	......	......	......	......	......	......	......	7.57½	7.62½	7.26½	6.5	6.55
2	......	......	......	......	......	......	......	5.5	7.95	6.85	6.5	6.4
3	......	......	......	......	......	......	......	6.3	7.8	6.95	6.5	6 5
4	......	......	......	......	......	......	......	6.25	7.61½	6.8	6.45	6.85
5	......	......	......	......	......	......	......	6.17½	7.42½	6.7	6.4	6 87
6	......	......	......	......	......	......	......	6.35	6.97½	6.62½	6.4	6.85
7	......	......	......	......	......	......	......	9.75½	3.87½	6.55	6.4	6 92
8	......	......	......	......	......	......	6.5	7.35	6.77½	6.55	6.4	7.0
9	......	......	......	......	......	......	6.4	6.92½	6.67½	6.52½	6.4	7.2
10	......	......	......	......	......	......	6.25	6.62½	6.6	6.45	6 4	9.2
11	......	......	......	......	......	......	6.2	7.17½	6.6	6.42½	6.37	9.25
12	......	......	......	......	......	......	6.26	7.42½	6.65	6.42½	6.45	8.22
13	......	......	......	......	......	......	6.3	6.87½	6.72½	6.5	6.95	7.75
14	......	......	......	......	......	......	6.33	6.55	6 57½	7.25	6.8	8.97
15	......	......	......	......	......	......	6.3	6.50	6.5	7.72½	6.63	16.75
16	......	......	......	......	......	......	6.38	6.52½	6.62½	7.37½	6.6	10.6
17	......	......	......	......	......	......	6.3	6.5	6 67½	7.1	6.55	8.95
18	......	......	......	......	......	......	6 85	6.75½	7.05	7.0	6.65	8.4
19	......	......	......	......	......	......	6.55	7.	6.85	6.9	6.55	7.77
20	......	......	......	......	......	......	6.48	6.95	6.65	6.8	6.5	7.55
21	......	......	......	......	......	......	6.47½	8.75	6.55	6.72½	6.4	7.55
22	......	......	......	......	......	......	6.37½	8.15	6.52½	6 7	6.35	7.57
23	......	......	......	......	......	......	6.4	7.5	6.47½	6.7	6 4	7.95
24	......	......	......	......	......	......	6.35	9.0	6.42½	6.6	6.5	7.75
25	......	......	......	......	......	......	6.35	9.4	6.4	6.6	7.6	7.22
26	......	......	......	......	......	......	6.3	8.1	6.35	6.6	7.25	7.12
27	......	......	......	......	......	......	6.47½	7.47½	6.32½	6.6	6.97	7.0
28	......	......	......	......	......	......	6.42½	7.15	6.3	6.65	6.87	7.85
29	......	......	......	......	......	......	6.37½	6.95	7.05	6.5	6.8	9.1
30	......	......	......	......	......	......	6.67½	7.42½	7.41½	6.5	6.8	12.12
31	......	......	......	......	......	......	6.72½	6.72½	......	6.5	......	10.0

DIVERSION FROM RONDOUT CREEK TO FEED DELAWARE AND HUDSON CANAL.

The Delaware and Hudson Canal follows slackwater from the mouth of Rondout Creek to Eddyville. From the head of the pond above Eddyville dam the canal runs parallel to Rondout River as far as Napanoch. From Napanoch to Summitville it follows the valley of Sandberg Creek, tributary to Rondout River at Napanoch. Numerous dams on Sandberg Creek, also dams on Rondout Creek at Port Hixon and High Falls, formerly supplied the canal with water from its Summitville level to Hudson River tide water. The Delaware and Hudson Canal was originally constructed in 1826. In 1898 it was abandoned from Honesdale, Pa., to Ellenville, N. Y. August 1, 1901, the remaining canal, with the exception of that from High Falls Feeder to Rondout, was abandoned. The gaging station on Rondout Creek at Rosendale is situated opposite the canal level between locks 6 and 7. The water supply is entirely drawn from the dam and feeder on Rondout Creek below High Falls. A current meter measurement of the flow in the feeder September 19, 1901, showed the diversion from Rondout Creek to be 25 second-feet at the dam. A measurement of the outflow from the Rosendale level showed the flow in the canal past the gaging station to be 10 second-feet, the remainder of the diverted water having been returned over three intervening waste-weirs.

The presence of the canal parallel with the river probably increases the loss from surface evaporation on Rondout Creek to some extent. The canal follows the left-hand bank of Rondout Creek and intercepts some inflow from drainage on that side. All water diverted from Rondout Creek at High Falls feeder, with the exception of evaporation losses, is returned to the stream before it reaches Rondout. A part of this water is carried past the gaging station at Rosendale. In order to determine the amount of this diversion during the season of canal navigation, usually from April 1st to December 15th, a record has been kept

Fig. No. 110.—Rondout Creek: Honk Falls, Napanoch, Ulster County, N Y

Fig. No. 111 —Rondout Creek: High Falls, in village of High Falls, Ulster County, N Y.

Fig. No. 112.—Rondout Creek: Honk Falls Dam Gauging Station above Napanoch, Ulster County, N. Y.

at Lock 6 or Creek Locks, at the lower end of the Rosendale level. The record includes:

(1) Overflow of by-pass weir.

(2) Water used for lockage.

(3) Flow through paddles in mitre gates.

There is also a small amount of leakage of the lock walls and gates which has not been estimated. The flow in the canal at lock 6, added to the flow at the Rosendale gauging station, will give the total actual run-off from Rondout Creek watershed above Rosendale. A record at lock 6 has been kept since October 1, 1901, showing the mean monthly diversion as follows:

October, 1901	20 second-feet.
November, 1901	19 second-feet.

RONDOUT CREEK AT HONK FALLS, ULSTER COUNTY, N. Y.

Rondout Creek above its junction with Sandberg Creek at Napanoch (also called Lackawack Creek), is essentially a mountain stream. At Honk Falls, a natural declivity affords a fall of 125 feet over tilted strata of Hudson River shale. This fall has been increased to 147.5 feet by the construction of a masonry dam at the head of the gorge.

Water to feed the turbines is carried to the power house, one-fourth mile below the dam, in a circular steel penstock. The turbines are a special design of the Victor type. The outflow from the turbines passes over a tailrace weir below the power house. The total flow of the stream passes either over the spillway of the dam or over the tailrace weir. The dam is of concrete masonry. It has an Ogee shaped cross section and a level spillway 186.6 feet in length.

Arrangements have been made for maintaining a record at this plant. A Bristol recording gauge will be placed above the dam, arranged to keep a continuous record of the discharge over the dam; a record of the amount of water used by the turbines will also be kept. The maximum observed discharge of Rondout Creek at Honk Falls has been 8,650 second-feet or 98.1 second-feet per square mile from the tributary drainage area of 88 square miles.

The power is used for the generation of electricity which is transmitted to Ellenville a distance of three miles.

Principal Developed Water Powers on Rondout Creek, Ulster County, in 1901.

Number of dams.	LOCATION.	Name of mill and of owner or operator.	Business or class of manufacture.	Working Head of Water Wheels, in Feet. Greatest.	Least.	Average.	Water privilege at dam.	Rated power of water wheels at usual head, H. P.	H. P. of engines.	Remarks.
1	Eddyville	D. and H. Canal Company	Slack water navigation				Entire.	None.	None.	
2	Lawrenceville		Natural cement			10	Entire.			Power not used.
3	Below High Falls	—— ——	Natural cement and canal feeder	14	10			80	125	Dam also feeds D. and H. canal.
4	High Falls	Hasbrook & Hopper, Ulster County Savings Banks	Flour mill			12	Entire.			
5	High Falls		Abandoned			81	Entire.			Abandoned.
6	Port Hickson	D. and H. Canal	Canal feeder			10	Entire.			Abandoned.
7	Napanoch		Flour mill			6	Entire.	60	None.	Upper Rondout or Lackawack Co.
8	Napanoch		Grind shop			7	Entire.			
9	Napanoch, R. H.		Paper mill			30	½	481		
10	Napanoch, L. H.		Paper mill			80	½			
11	Napanoch		Edge tools							
12	Napanoch, L. H.	Napanoch Knife Company	Edge tools			13½		12	None.	
13	Napanoch, L. H.									Abandoned privilege.
14	Napanoch, R. H.	Young & Humphrey, John Russell,	Barking knife works				½			
15	Napanoch, L. H.					56	½	598		
16	Napanoch	—— ——				147.5	Entire.	1,500	None.	
17	Lackawack	C. N. Morse		11		10	Entire.	140	None.	
18	Grahamsville		—— ——							
19	Bull River		Two sawmills					50-100		

Fig. No. 114.—Wallkill River: Dashville Falls near Rosendale, Ulster County, N. Y.

WALLKILL RIVER AT NEW PALTZ, ULSTER COUNTY, N. Y.

Wallkill or New Paltz River has its source in Sparta Mountain, New Jersey, about twenty-one miles from the point where it enters New York State.[a] From its source to the head of the Drowned Lands it is essentially a highland stream. Mr. Vermeule states that high-water marks on Clove River, one of the tributaries of Wallkill River in this region, indicate a maximum discharge of 67 second-feet from a drainage area of 0.7 square miles, or at the rate of 96 second-feet per square mile.

The Drowned Lands are an extensive Pleistocene lake bottom situated mainly in New York. They comprise an area of 28 square miles. A dam of drift at the north end of this tract holds back the water of the Wallkill, causing an overflowing of this entire flood plain. Until about 55 years ago, this area formed a shallow lake or undrained swamp. An artificial canal cut through the drift at the foot has enabled a large part of the downstream portion to be reclaimed for agricultural purposes.

Below the foot of the Drowned Lands, 15 miles from the New Jersey line, the Wallkill flows in a broad, shallow valley, averaging perhaps one-half mile in width. This valley has been eroded from the drift, leaving a stream-bed of cobble and small boulders too heavy for stream transport. The river terraces are not abrupt, often curving gracefully to the uplands 30 to 60 feet above the stream, and leaving a narrow flood plain submerged only during freshets. At frequent intervals the stream cuts through the overlying drift to the Hudson River slate, and passing over ledges of this slate produces waterfalls.[b]

Much of the fall of the stream is concentrated in a number of such cascades having natural declivities as follows:

LOCATION.	Approximate fall, in feet.
Montgomery	9
Walden	26
Wallkill	10
Dashville	42
Ritton Glen	21

a The Wallkill in New Jersey is described in Geological Survey, New Jersey, Vol. 8, Water Supply, by C. C. Vermeule, pp. 147-150; see also The Wallkill, Appendix No. 14, pp. 516-580, Report on New York's Water Supply, by John R. Freeman.

b The Geology of Orange County, N. Y., by Heinrich Ries, Ph.D. New York State Museum Report 1895, Part 2, pp. 395-475.

The draining of the Drowned Lands is believed to have affected the summer flow of the stream in some degree.

At Gardiner, the Wallkill receives its principal tributary, the Shawangunk Kill. The divide between the two streams is formed by vertical strata of a blue shale fold, making a very definite ridge between the drainage basins.

The gauging station is situated in a drift filled valley at New Paltz highway bridge. The station was established July 7, 1901. Readings of the river stage have been taken twice daily since that date by the observer, E. Tremper. The gauge consists of a 15-foot boxed scale graduated decimally, attached horizontally to the tie rods on the downstream side near the left-hand end of the bridge. The bridge has a span of 146.6 feet between the vertical faces of the masonry abutments. The entire flow passes under this bridge except during extreme freshets, when a flood plain on the left-hand bank is overflowed. At such time discharge measurements can be made at the Wallkill Valley Railroad bridge three miles downstream, where the entire flow is confined to the stream channel at all stages.

The bench mark is a circular chisel draft in the coping on the capstone forming the bridge seat on the right-hand abutment.

Elevation bench mark	100.00
Elevation water surface when gauge reads zero	70.96

Current Meter Measurements of Wallkill River at New Paltz, Ulster County, N. Y.

DATE.	Gauge height, feet.	Discharge, second-feet.	Hydrographer.
1901.			
November 9	5.94	178	W. W. Schlecht.
July 23	5.20	306	A. E. Place.
October 11	6.30	340	W. W. Schlecht.
October 11	6.30	355	George B. Hollister.
October 24	6.33	333	W. W. Schlecht.
October 9	6.48	398	W. W. Schlecht.
November 16	6.50	402	W. W. Schlecht.
July 7	7.19	824	Horton and Hollister.
July 8	7.25	842	Horton and Hollister.
October 1	7.36	896	W. W. Schlecht.
November 27	7.52	1,022	W. W. Schlecht.
September 19	7.78	1,076	Horton, Place and Schlecht.
August 13	7.85	1,088	A. E. Place.
July 19	8.23	1,248	A. E. Place.
September 5	8.90	1,676	A. E. Place.
August 31	9.07	1,917	A. E. Place.
August 20	10.00	2,729	Hollister and Place.
August 28	10.60	2,982	A. E. Place.
December 11	11.50	3,040	W. W. Schlecht. *a*
December 19	13.70	3,277	W. W. Schlecht. *a*
August 7	14.85	7,365	A. E. Place.

a Stream obstructed by ice causing backwater.

December 30, 1901, the river obtained a maximum stage of 20.5 feet.

Drainage Areas of Wallkill River.

LOCATION.	Square miles.
Wallkill River above Franklin Furnace, New Jersey	31
Wallkill River at New York and New Jersey State line	210
Wallkill River above foot of Drowned Lands	393
Wallkill River above Freeman's proposed dam site	464
Wallkill River, mouth Shawangunk Kill	563
Shawangunk Kill above mouth	149
Wallkill River below mouth, Shawangunk Kill	712
Wallkill River above gauging station at New Paltz	736
Wallkill River above Rifton Glen	761
Wallkill River junction with Rondout Creek	779
Wallkill River total drainage in New York	567

A current meter measurement of the discharge of Wallkill River, at Rockford Bridge, N. Y., was made August 13, 190[illegible], by E. G. Paul, showing a discharge of [illegible] second-feet.

Throughout its course the Wallkill flows northeasterly nearly parallel to Hudson River. It joins Rondout River near Lefever Falls, and the two enter Hudson River at Rondout. Together they form the most extensive river system in southeastern New York, aside from the Hudson River.

Mean Monthly Run-off of Wallkill River at New Paltz, Ulster County, N. Y.

[Drainage area, [illegible] square miles.]

YEAR.	Second-feet.	Second-feet per square mile.	Inches on drainage area.
[illegible]			
July	[illegible]	0.[illegible]	0.[illegible]
August	2,[illegible]	2.[illegible]	[illegible]
September	[illegible]	1.[illegible]	1.[illegible]
October	[illegible]	0.[illegible]	0.[illegible]

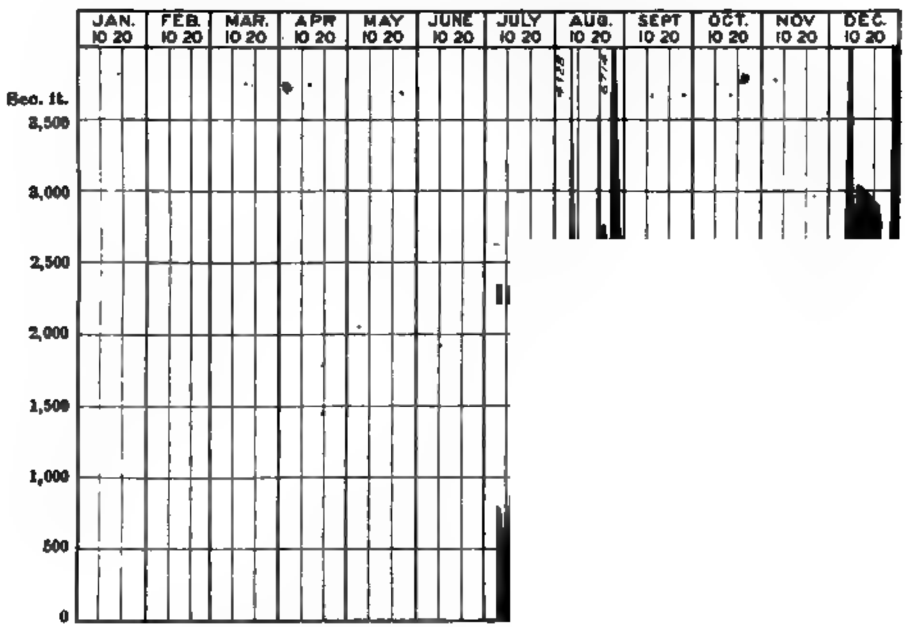

Fig. No. 113.—Discharge of Wallkill River at New Paltz, Ulster County, N. Y., 1901.

Principal Developed Water Powers on Wallkill River in 1901.

Number of dams.	LOCATION.	Name of mill and of owner or operator.	Business or class of manufacture.	WORKING HEAD OF WATER WHEELS, IN FEET. Greatest.	Least.	Average.	Water privilege at dam.	Rated power of water wheels at usual head, H. P.	H. P. of engines.	[redacted]
1	Creek Locks	& [redacted]	der	19	9	14	En[redacted]	268	100	
2	Rifton	nick, Jr.				16		119		
3	Rifton	J. M. Dimick Company	Wilton rugs	32	31		Entire	679		
4	Dashville		ill	42						Abandoned about 1845.
5	Galeville		ill			10				
6	Wallkill	J. C. Hedden		14			Entire			
7	Walden	Walden Knife Company		12	11	8	452 sq. inches.	150	75	
8	Walden	N. Y. Knife Works		33	31½	32		300	None.	
9	Montgomery	Crabtree and Patchett				9	Entire	100	75	
10	Red Mills	Red Mill*				10	Entire		None.	

*On Shawangunk Kill.

Mean Daily Flow in Second-feet of Wallkill River at New Paltz, N. Y.

[Drainage area, 736 square miles.]

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1	......	......	......	......	......	......	......	264	1,940	886	220	330
2	......	......	......	......	......	......	......	190	2,423	790	220	242
3	......	......	......	......	......	......	......	212	2,345	742	220	220
4	......	......	......	......	......	......	......	220	2,045	670	220	308
5	......	......	......	......	......	......	......	418	1,508	647	242	374
6	......	......	......	......	......	......	......	418	1,380	601	264	509
7	......	......	......	......	......	......	801	4,328	1,200	509	220	486
8	......	......	......	......	......	......	780	3,590	1,014	429	205	814
9	......	......	......	......	......	......	638	2,010	886	374	175	2,540
10	......	......	......	......	......	......	509	1,905	896	352	145	4,508
11	......	......	......	......	......	......	453	1,870	790	352	115	3,998
12	......	......	......	......	......	......	828	1,200	694	308	205	2,786
13	......	......	......	......	......	......	961	1,014	742	308	396	2,540
14	......	......	......	......	......	......	742	742	647	374	670	3,034
15	......	......	......	......	......	......	1,082	862	509	910	624	5,588
16	......	......	......	......	......	......	463	718	555	1,082	463	5,117
17	......	......	......	......	......	......	382	555	694	910	330	5,376
18	......	......	......	......	......	......	742	1,975	974	882	242	5,968
19	......	......	......	......	......	......	1,159	3,502	988	742	286	6,080
20	......	......	......	......	......	......	766	2,622	886	647	374	5,219
21	......	......	......	......	......	......	440	2,745	814	582	814	3,998
22	......	......	......	......	......	......	374	2,745	718	418	1,230	4,118
23	......	......	......	......	......	......	330	2,083	647	363	1,569	2,903
24	......	......	......	......	......	......	242	2,306	580	352	1,380	2,083
25	......	......	......	......	......	......	220	6,714	509	308	1,230	2,189
26	......	......	......	......	......	......	220	4,230	440	275	1,330	1,800
27	......	......	......	......	......	......	175	3,590	374	264	647	1,975
28	......	......	......	......	......	......	175	3,034	374	264	601	2,306
29	......	......	......	......	......	......	175	2,622	509	264	509	4,682
30	......	......	......	......	......	......	160	2,462	790	264	418	...... a
31	....	......	......	......	......	......	265	1,905	......	440	......	...... a
Mean	......	......	......	......	......	......	521	2,077	983	522	530	2,832

a Exceeds limit of rating curve.

FISHKILL CREEK AT GLENHAM, DUTCHESS COUNTY, NEW YORK.

The headwaters of Fishkill Creek drain the western slope of Chestnut Ridge Mountains. In its upper reaches the stream receives the drainage from extensive swamp and flat lands. The lower reaches of the stream flow along the foot of the Fishkill Range. From Fishkill Village to Fishkill Landing, where it empties into tide water of Hudson River, it falls over slate rock ledges, making a descent of 200 feet in five miles. This fall is largely utilized to provide water power for manufactories on its banks. As a result, the stream becomes greatly polluted from manufacturing waste and other impurities which it receives. The extent and character of the manufactures are shown in the accompanying table at page 585.[a]

a For effect on streams of waste from above classes of manufactures, see Sewage Disposal in the United States, Rafter and Baker, pp. 12–32.

The gauging station is situated at the Newburgh, Dutchess and Connecticut R. R. bridge in Glenham. It was established July 8, 1901. A boxed weight gauge with scale graduated decimally from zero to 15 feet was attached to the upstream guard-rail of the bridge. The water height is observed each morning and evening by the gauge reader, C. E. Carey. The bridge consists of a main central span with two auxiliary overflow channels at the ends, the length of span being as follows:

Left-hand overflow	station 0.0 to 22.5
Main span	station 27.5 to station 122.0
Right-hand overflow	station 127.0 to station 149.0

The bed of the main channel is earth and gravel, that of the overflow channels is of loose broken stone. The bench mark is an "0" chiseled in the upstream corner of the left-hand pier of the main bridge span.

Elevation of bench mark............................	100.00
Elevation of water surface when gauge reads zero....	82.22

The location of the gauging station is shown on the Poughkeepsie Sheet of the Topographic Atlas of the U. S. Geological Survey.

Current Meter Measurements of Fishkill Creek at Glenham, Dutchess County, N. Y.

DATE.	Gauge height, feet.	Discharge, second-feet.	Hydrographer.
1901.			
July 24	3.60	60	A. E. Place.
October 12	3.80	97	G. B. Hollister.
November 11	3.85	82	W. W. Schlecht.
August 15	3.85	110	A. E. Place.
September 27	3.86	90	W. W. Schlecht.
July 20	3.90	135	A. E. Place.
July 8	3.92	147	Horton and Hollister.
November 20	3.95	114	W. W. Schlecht.
October 5	3.98	126	W. W. Schlecht.
October 15	4.05	137	W. W. Schlecht.
September 6	4.15	193	A. E. Place.
September 18	4.22	229	A. E. Place.
December 24	4.52	315	W. W. Schlecht.
August 21	4.56	342	A. E. Place.
August 30	4.60	335	A. E. Place.
December 18	4.62	375	W. W. Schlecht.
October 16	5.10	579	W. W. Schlecht.
December 31	7.43	2,210	W. W. Schlecht. *a*

a Surface velocity used.

A measurement through ice 0.3 to 0.4 foot thick was made by W. W. Schlecht December 7, 1901. Gauge height, 4.25; discharge, 100.7 second-feet.

A mark is painted on the right-hand overflow abutment, labeled "high-water mark, January 22, 1891." The elevation of this mark was found to be 96.15, equivalent to a gauge reading of 13.93 feet, and this is said to be the highest water on record in the stream. The drainage area above the gauging station is 198 square miles, and above the mouth of the stream, 204 square miles.

Principal Developed Water Powers on Fishkill Creek in 1891.

Number of dams.	LOCATION.	Name of mill and of owner or operator.	Business or class of manufacture.	WORKING HEAD ON WATER WHEELS, IN FEET. Greatest.	Least.	Average.	Water privilege at dam.	Rated power of water wheels at usual head, H. P.	H. P. of engines.	
1	Fishkill	Tioronda Hat Works					Entire			
2	Fishkill			24		17	Entire	480	250	
3	Fishkill						Entire			
4	Matteawan			31	20	25	Part	163	225	
5	Matteawan					26	Part	283	140	
6	Matteawan					20	Entire		525	
7	Glenham			35	30	32½	Entire	460	1,500	Not operated.

Daily Gauge Height of Fishkill Creek at Glenham, N. Y.

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1	......	......	......	......	......	......	......	3.95	4.57½	4.05	3.97½	3.90
2	......	......	......	......	......	......	......	3.82½	4.60	3.97½	3.95	3.98
3	......	......	......	......	......	......	......	3.77½	4.47½	4.10	3.95	4.05
4	......	......	......	......	......	......	......	3.67½	4.42½	4.10	3.95	4.08
5	......	......	......	......	......	......	......	3.65	4.30	4.00	3.90	4.10
6	......	......	......	......	......	......	......	3.65	4.15	3.92½	3.90	4.25
7	......	......	......	......	......	......	......	4.70	4.17½	3.90	3.92½	4.28
8	......	......	......	......	......	......	3.90	5.55	4.10	3.87½	3.95	4.18
9	......	......	......	......	......	......	3.90	4.77½	4.07½	3.85	3.90	4.45
10	......	......	......	......	......	......	3.80	4.35	4.02½	3.85	3.87½	4.73
11	......	......	......	......	......	......	3.78	4.12½	4.05	3.85	3.87½	5.33
12	......	......	......	......	......	......	3.83	4.07½	4.37½	3.80	3.92½	4.83
13	......	......	......	......	......	......	3.80	4.02½	4.32½	3.80	4.32½	4.60
14	......	......	......	......	......	......	3.73	3.90	4.15	4.30	4.17½	4.68
15	......	......	......	......	......	......	3.70	3.90	4.10	4.35	4.05	6.78
16	......	......	......	......	......	......	3.65	3.82½	4.25	4.32½	4.00	7.45
17	......	......	......	......	......	......	3.73	3.85	4.15	4.55	3.95	6.18
18	......	......	......	......	......	......	4.23	5.07½	4.22½	4.40	3.95	5.53
19	......	......	......	......	......	......	4.00	4.70	4.12½	4.32½	3.95	5.15
20	......	......	......	......	......	......	3.90	4.40	4.02½	4.22½	3.95	4.98
21	......	......	......	......	......	......	3.77½	4.45	4.02½	4.20	3.98	4.78
22	......	......	......	......	......	......	3.70	4.95	4.00	4.15	3.93	4.73
23	......	......	......	......	......	......	3.65	4.62½	3.92½	4.12½	3.90	4.73
24	......	......	......	......	......	......	3.65	4.70	3.90	4.10	3.90	4.65
25	......	......	......	......	......	......	3.65	6.40	3.87½	4.05	4.35	4.60
26	......	......	......	......	......	......	3.62½	6.55	3.85	4.00	4.33	4.55
27	......	......	......	......	......	......	3.60	5.65	3.80	4.00	4.18	4.85
28	......	......	......	......	......	......	3.45	5.20	3.87½	4.00	4.03	4.15
29	......	......	......	......	......	......	3.57½	4.85	3.96	4.00	4.00	5.75
30	......	......	......	......	......	......	4.35	4.70	4.20	4.00	3.98	8.28
31	......	......	......	......	......	......	4.15	4.57½	......	3.97½	......	7.50

CROTON RIVER AT OLD CROTON DAM, WESTCHESTER COUNTY, N. Y.

Croton River drains an area of rough, irregular topography, interspersed with lakes and ponds, situated east of Hudson River, to which the stream is tributary at Croton Landing. This stream serves as the principal source of water supply for New York City.[a] The flow is diverted through a closed masonry aqueduct at what is called the Old Croton dam, to distinguish it from the new Croton dam, also called the Cornell or Quaker Bridge dam, now under construction.[b] The location of the Old Croton dam, and of the adjacent watershed, is shown on the Carmel and Tarrytown Sheets of the topographic atlas of the U. S. Geological Survey. A record has been kept of the flow of Croton River at the Old Croton dam, beginning in 1868. The record includes the quantity of water wasted over the crest of the dam, as well as that diverted

a See History of Water Supply of New York, 1658–1895, by Edward Wedgman.

b The new Croton dam is described in paper by Charles S. Gowen, Transaction Am. Soc. C. E., Vol. XLIII, pp. 469–665.

for the water supply of New York City. The results of this record, as originally computed, have been widely published.[a]

In the report on New York's water supply, made to Bird S. Coler, Comptroller, by John R. Freeman, 1900; Appendix No. 1, pages 120-256 inclusive, is devoted to a study of the yield of the Croton Watershed. Mr. Freeman states that the results as heretofore published, average about ten per cent., or 38,000,000 gallons per day, too large, because of the use of data which was less accurate than that now possessed. Using this later information, he has recomputed the entire record. Owing to the importance of this record, its great length, relative accuracy, and availability for comparison with other streams proposed as sources of water supply for Greater New York, it has been thought well to republish the revised figures which are given below. In computing the record, Mr. Freeman has made the following changes in the methods of calculation:

1. Revision of the formula for flow over the dam by experiment on model sections at Cornell University Hydraulic Laboratory. In the calculation of the record as hitherto published, the flow over the dam has been calculated, using a constant coefficient in the weir formula of 3.4, based on the experiments of Eytelwein.

2. Gaugings of flow in the Croton Aqueduct have been made and the results used as a basis of calculation of the diversion.

3. The impairment of the carrying capacity of the aqueduct, due to the gradual accumulation of slime or organic growths upon the walls of the conduit, has been taken into consideration.

4. The effect of storage in the natural and artificial reservoirs in the headwaters of the stream, has been allowed-for in the calculation, so that the results as given below represent the estimated *natural* run-off of the watershed.

5. Errors in the assumed elevation of the crest, and length of the overfall of the Croton dam, and in the observed depth on the crest of the dam, and depth in the new Croton Aqueduct, have been corrected in making the revised calculations.

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[a] See Twentieth Annual Report U. S. Geol. Survey, part 4, pp. 81-84; also Report of New York Aqueduct Commission, 1887-1895, pp. 94-101.

The depth on the crest of the dam has been determined by measuring the distance down to the water surface from the corner of the coping stone of the wing wall on the east bank of the stream, at a point just downstream from the intake of the old aqueduct and about 120 feet upstream from the crest. The measurement has been taken at 5 o'clock each morning, and as there are no notable mills on the stream, one measurement a day undoubtedly gives a reliable record of the mean wastage. The dam consists of two portions, having different cross-sections. Both sections are built of cut stone with gravel and riprap or concrete backing, and rest on rock foundations. The longer or round-crested portion is 180.3 feet in length. The crest lip has an elevation varying from 166.170 feet to 166.299 feet. The crest is Ogee shape, the upper portion having a radius of 10 feet; the slope of the upstream side being approximately 6.5 horizontal to 1 vertical. The angular-crested portion of the dam is 71.1 feet in length; its elevation varying from 166.175 to 166.915 feet. The elevation of the point of measuring the depth on the crest is 172.210 feet and the mean elevation of the crest is 5.975 feet lower. The angular-crested portion of the dam has a crest 7 feet in width, sloping bcakward 1 vertical to 7 horizontal, and an apron having a slope of 5 horizontal to 4 vertical.

Regarding the accuracy of the record as recomputed, Mr. Freeman states that there are probably very few months in the record for which the error is as great as 5 per cent. and believes it probable that the error in the mean run-off for any year rarely, if ever, exceeds 3 per cent. Whatever uncertainty there is comes mainly from lack of precision in measurement of depth wasting over dam, and from uncertainty as to the condition of interior surface of the two aqueducts, or obstruction therein.

With reference to the effect of storage, the following table is given by Mr. Freeman, showing the total capacity in millions of gallons to crest level of the different reservoirs within the watershed.

Storage Reservoirs in Croton River Drainage Area.

RESERVOIR.	Date when first filled and available.	Approximate area of tributary watershed, square miles.	Area of water surface of storage reservoir in square miles.	Aggregate area of water surface in watershed of reservoir, square miles.	Approximate area of swamp surface in watershed, square miles.	Net area of land surface, square miles.	Per cent of water surface to land surface.	Total capacity of reservoir to level of spillway crest, millions of gallons.
1.	2.	3.	4.	5.	6.	7.	8.	9.
Boyd's Corner, Carmel....	1873	21.43	0.463	0.675	0.0	20.75	3.25	2,727
West branch..............	1895	19.51	1.560	2.304	0.8	17.21	13.40	10,070
Middle branch.........	1878	20.51	0.672	0.766	0.7	19.74	3.88	4,005
East branch, Bog brook and Sodum............	1891	76.90	{ 0.640 0.898 }	2.125	5.0	74.78	2.84	{ 4.145 4.883 }
Titicus..................	1893	22.80	1.103	1.300	0.5	21.50	6.04	7.167
Amawalk	1897	18.32	0.940	2 132	0.05	16.19	13.20	76.78
Old Croton...............	1842	159.3	0.760	1.938	0.7	157.4	1.23	....

The total drainage area above old Croton dam is 338.8 square miles.

In addition to the above artificial reservoirs, the following ponds are controlled by the city: Mahopac, Kirk, Gleneida, Gilead, Barrett, White. These have an aggregate capacity above present level of spillway crests of 2,055,000 gallons.

The following ponds are not controlled by the city, but were drawn upon in the great drought in 1881: Peach, Waccabuc, Cross, China, Pine, Long, Tonetta, Haines. They have an aggregate capacity of 855,000,000 gallons.

In the above estimate of the natural run-off of Croton Watershed, no allowance has been made for the increased loss by evaporation due to the larger proportion of water surface than would have existed in absence of the artificial reservoirs. The area of water surface exposed to evaporation for different periods during the continuation of the record has been as follows:

Average Monthly Flow of Croton River at Old Croton Dam, Westchester County, N. Y., in Second-Feet.

MONTH.	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.
January	614	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
February	242	974	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
March	1,149	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
April	[illegible]	916	1,214	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
May	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
June	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
July	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	345	[illegible]
August	541	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
September	[illegible]	54	97	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
October	[illegible]	[illegible]	111	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
November	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
December	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

MONTH.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.
January	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
February	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	418	[illegible]
March	[illegible]	[illegible]	[illegible]	541	[illegible]	1,170	[illegible]	[illegible]
April	[illegible]	913	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
May	540	[illegible]	712	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
June	212	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
July	156	710	147	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
August	147	[illegible]	[illegible]	1,115	164	[illegible]	[illegible]	[illegible]
September	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
October	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
November	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	419	[illegible]
December	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	441	[illegible]

MONTH.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
January	444	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	....	....
February	620	[illegible]	[illegible]	644	1,470	[illegible]	....	....
March	1,363	907	[illegible]	[illegible]	[illegible]	[illegible]	....	....
April	653	[illegible]	[illegible]	[illegible]	[illegible]	1,119	....	....
May	496	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	....	....
June	424	[illegible]	311	[illegible]	[illegible]	[illegible]	....	....
July	[illegible]	[illegible]	[illegible]	719	[illegible]	[illegible]	....	....
August	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	....	....
September	261	277	[illegible]	[illegible]	[illegible]	[illegible]	....	....
October	344	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	....	....
November	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	....	....
December	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	....	....

Average Monthly Flow of Croton River at Old Croton Dam, Westchester County, N. Y.
[In second-feet per square mile.]

MONTH.	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.
January	1.53	1.74	3.07	.447	1.58	3.39	3.19	.48	1.10
February	.68	1.60	3.70	1.90	.98	1.42	2.87	2.56	3.07
March	3.39	4.23	3.74	3.71	1.83	3.14	3.31	3.49	5.32
April	3.04	2.71	3.59	1.57	2.47	5.79	2.59	4.51	5.06
May	4.64	2.21	1.33	1.60	.98	1.65	2.46	1.39	1.53
June	3.64	1.05	.64	1.13	.94	.42	.70	.44	.55
July	.96	.46	.30	.59	.44	.37	1.06	.43	.41
August	1.50	.36	.39	.65	1.36	.65	.67	4.39	.38
September	.44	.16	.39	.45	.95	.41	.45	.67	.30
October	3.39	2.07	.33	1.54	.53	1.09	.59	.84	.39
November	2.75	1.64	.49	2.96	2.13	1.34	.54	1.74	.66
December	1.21	3.49	.46	1.74	1.06	2.33	.889	1.36	.36
Year	2.45	1.74	1.44	1.43	1.34	1.84	1.85	1.81	1.58

MONTH.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.
January	.61	2.34	1.07	2.09	.56	1.81	.66	1.54	3.36
February	1.26	3.31	2.86	2.41	3.91	3.79	2.98	4.47	2.18
March	5.37	3.00	3.31	2.26	4.89	4.03	3.25	3.96	1.57
April	2.84	1.31	4.06	1.66	1.47	1.11	2.17	2.40	3.09
May	.67	1.17	1.45	.67	1.04	1.78	1.08	1.46	1.81
June	.47	1.147	.89	.41	1.84	1.58	.53	.89	.46
July	.38	.53	.55	.41	.43	.63	.41	.63	.39
August	.37	.69	1.06	.38	.41	.41	.41	.32	.44
September	.27	1.37	.87	.39	.41	2.65	.39	.57	.35
October	.79	.69	.48	.38	.41	1.73	.60	.43	.48
November	3.45	1.64	.63	.44	.36	.74	.58	.78	1.67
December	1.49	6.06	1.46	.41	1.36	.36	.47	3.04	1.63
Year	1.46	1.95	[illegible]	[illegible]	1.35	1.73	1.08	[illegible]	1.81

MONTH.	1886.							
January	2.75							
February	4.29							
March	1.94							
April	3.31							
May	1.65							
June	.68							
July	.46							
August	.48							
September	.38							
October	.39							
November	.69							
December	.96							
Year	1.60	1.98	3.50	2.32	1.91	1.90	1.19	3.065

MONTH.	1894.	1895.	1896.	[illegible]	1898.	1899.	1900.	1901.
January	1.31	3.26	1.03	1.096	2.98	3.17	....	....
February	1.58	.91	2.07	1.90	4.81	2.57	....	....
March	4.08	3.48	4.63	2.44	2.63	6.06	....	....
April	1.98	3.15	2.84	3.01	1.76	2.80	....	....
May	1.47	1.04	.47	3.36	2.39	.96	....	....
June	1.35	.75	.82	1.19	1.56	1.05	....	....
July	.76	.75	.86	2.11	.95	1.01	....	....
August	.74	.79	.83	2.44	1.77	1.05	....	....
September	.77	.62	.89	1.01	[illegible]	1.02	....	....
October	.72	.75	.89	.80	1.15	1.04	....	....
November	1.95	.73	1.29	.91	1.67	1.04	....	....
December	1.77	.75	.91	1.79	3.67	1.03	....	....
Year	1.54	1.29	1.47	[illegible]	3.19	1.94	....	....

Average Monthly Flow of Croton River at Old Croton Dam, Westchester County, N. Y., in Millions of U. S. Gallons, per Day.

MONTH.	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.
January	[illegible]	[illegible]	632	98	[illegible]	[illegible]	1,5[illegible]	[illegible]
February	156	[illegible]	[illegible]	436	[illegible]	[illegible]	524	[illegible]
March	742	945	606	386	282	[illegible]	386	[illegible]
April	665	582	735	364	[illegible]	1,2[illegible]	482	[illegible]
May	1,9[illegible]3	494	303	363	[illegible]	[illegible]	536	[illegible]
June	577	229	141	244	285	92	254	[illegible]
July	256	162	85	117	[illegible]	82	[illegible]	[illegible]
August	[illegible]	58	85	143	276	129	147	[illegible]
September	940	85	63	146	[illegible]	59	99	[illegible]
October	508	453	72	[illegible]	132	[illegible]	[illegible]	[illegible]
November	642	364	[illegible]	654	463	238	[illegible]	[illegible]
December	264	567	164	[illegible]	236	346	153	[illegible]

MONTH.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.
January	241	134	490	234	458	124	397	[illegible]
February	672	274	725	516	538	855	[illegible]	652
March	1,205	1,175	657	724	404	1,027	[illegible]	468
April	1,101	513	287	892	356	322	283	476
May	334	148	255	315	148	228	190	215
June	117	103	251	152	89	291	291	[illegible]
July	90	84	120	120	89	95	114	85
August	94	82	109	238	85	85	85	95
September	66	60	449	191	85	85	361	96
October	65	175	153	105	84	85	376	130
November	120	735	360	135	98	89	163	[illegible]
December	79	327	1,327	320	89	298	216	[illegible]

MONTH.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.
January	358	740	601	490	709	778	391	1,250
February	973	477	924	967	689	447	617	1,136
March	868	345	425	644	831	354	614	756
April	526	458	833	590	904	455	588	440
May	320	264	362	221	464	298	458	161
June	115	100	137	207	342	251	280	142
July	137	85	101	450	95	270	144	143
August	201	96	95	615	186	721	106	148
September	125	76	85	159	585	405	373	144
October	92	91	85	177	438	327	583	140
November	171	363	151	169	555	964	370	122
December	666	354	208	420	980	810	291	215

MONTH.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.
January	650	325	287	514	235	240	653	695
February	270	558	401	200	454	416	950	368
March	324	1,114	881	586	1,011	535	573	1,[illegible]
April	213	619	422	690	511	440	306	[illegible]
May	253	1,048	322	237	108	494	302	217
June	214	183	274	165	301	262	340	247
July	160	162	167	165	187	465	307	220
August	156	189	161	171	203	534	387	220
September	172	164	169	179	194	221	296	225
October	150	216	158	164	195	194	258	[illegible]
November	271	273	426	158	284	190	367	[illegible]
December	285	569	357	165	200	306	584	227

Total Monthly Run-off of Croton River in Inches on Drainage Area.

MONTH.	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.
January	1.75	2.01	3.54	.51	1.82	3.84	9.44	.53	1.27
February	.78	1.76	3.85	1.98	1.06	1.48	2.46	3.69	3.31
March	3.91	4.98	3.16	3.12	1.53	3.63	2.66	2.87	6.36
April	3.39	3.02	4.01	1.75	2.75	6.46	3.28	5.03	5.61
May	5.35	2.55	1.59	1.79	1.11	1.90	2.82	1.60	1.76
June	2.95	1.17	.71	1.25	1.05	.47	.78	.49	.59
July	.98	.53	.45	.61	.53	.43	1.24	.49	.47
August	1.83	.30	.45	.75	1.45	.63	.77	4.56	.44
September	.49	.18	.31	.54	1.06	.46	.50	.75	.33
October	2.64	2.88	.33	1.77	.95	1.26	.68	.78	.33
November	3.07	1.85	.55	3.33	2.36	1.49	.60	1.94	.61
December	1.395	2.57	.53	2.01	1.25	2.67	.80	1.57	.42

MONTH.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.
January	.70	2.58	1.28	2.41	.64	2.08	.99	1.77	3.89
February	1.30	3.45	.37	2.60	4.07	3.95	3.10	4.82	2.27
March	6.19	3.46	3.82	2.61	5.41	4.65	2.59	4.56	1.81
April	2.61	1.46	4.55	1.82	1.64	1.24	2.42	2.68	2.33
May	1.20	1.35	1.67	.77	1.20	2.05	1.18	1.68	1.39
June	.52	1.27	.77	.46	1.49	1.48	.59	.58	.51
July	.44	.63	.68	.47	.49	.60	.47	.78	.45
August	.48	.56	1.24	.44	.47	.47	.47	1.06	.51
September	.30	2.08	.97	.44	.46	2.95	.44	.64	.39
October	.91	.79	.55	.44	.47	1.98	.57	.48	.48
November	3.85	1.83	.69	.49	.40	.83	.59	.57	1.86
December	1.72	6.38	1.68	.47	1.57	1.13	.54	3.50	1.87

MONTH.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.
January	3.17	2.58	3.73	4.09	2.05	6.48	3.42	1.72
February	4.39	4.60	4.38	2.12	2.94	5.40	1.33	2.65
March	2.24	3.39	4.37	1.87	4.45	3.97	1.72	5.87
April	4.25	3.00	4.61	2.82	2.99	2.24	1.08	3.16
May	1.90	1.16	2.44	1.54	2.41	.85	1.32	5.52
June	.70	1.05	1.24	1.62	1.51	.71	1.09	.94
July	.58	2.41	.49	1.42	.76	.75	.84	.85
August	.49	3.24	.98	3.79	.55	.77	.82	.99
September	.44	.80	2.98	2.06	1.91	.74	.87	.84
October	.45	.98	2.30	1.72	3.09	.74	.78	1.13
November	.77	.86	2.33	4.92	1.88	.62	1.33	1.39
December	1.07	2.21	4.90	4.26	1.53	1.18	1.50	2.99

MONTH.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
January	1.51	2.71	1.18	1.26	3.44	3.65	....	....
February	1.99	.95	2.25	1.98	4.52	2.68	....	....
March	4.65	3.09	5.83	2.81	3.02	6.98	....	....
April	2.15	3.52	2.61	2.24	1.96	3.68	....	....
May	1.69	1.20	.54	2.61	4.48	1.14	....	....
June	1.39	.83	1.08	1.33	1.73	1.15	....	....
July	.83	.86	.98	2.46	1.09	1.16	....	....
August	.85	.90	1.06	2.81	2.04	1.21	....	....
September	.86	.92	.98	1.13	1.15	1.14	....	....
October	.83	.86	1.08	1.01	1.33	1.20	....	....
November	2.18	.80	1.44	1.02	1.86	1.16	....	....
December	2.04	.86	1.05	2.06	3.08	1.19	....	....

In estimating the relation of rainfall to run-off on this watershed, the mean monthly rainfall, as given in the following table, has been used by Mr. Freeman. This table is made up from rain gauge records kept at the following places:

1870 to 1876, Boyd's Corners.

1877, average of Boyd's and Croton records.

1878 to 1881, average of Boyd's, Croton and Middle Branch records.

1882 to 1900, average of Boyd's, Croton, Middle Branch and Carmel records.

These rainfall records have been used in estimating the percentage of run-off as hitherto published. The present change in the estimated run-off produces a change in the percentage of rainfall to run-off, and the values of this percentage deduced by Mr. Freeman are given below.

Total Monthly Precipitation on Croton River Watershed in Inches.

MONTH.	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.
January	2.90	3.79	4.51	3.80	1.44	5.66	6.96	2.74
February	1.38	3.64	6.40	3.81	1.22	3.09	2.78	3.47
March	2.55	5.48	3.80	4.27	2.59	3.08	1.57	4.99
April	3.87	2.11	5.45	3.01	3.04	3.77	6.31	3.04
May	3.79	4.52	2.80	3.45	3.69	2.91	1.99	1.08
June	4.58	3.59	2.06	5.78	4.00	.71	3.57	3.02
July	2.13	2.26	3.48	5.07	4.34	2.21	5.98	3.10
August	6.98	1.92	5.10	5.24	5.99	5.73	2.75	10.33
September	9.33	3.20	2.85	1.44	3.69	3.73	3.56	2.11
October	0.87	9.46	4.78	6.18	2.15	5.13	2.40	3.61
November	4.65	2.43	2.51	4.35	4.01	3.73	2.72	4.61
December	2.35	5.96	1.49	2.59	3.68	4.13	1.78	1.58

MONTH.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.
January	1.42	2.86	4.71	2.79	3.48	4.85	4.68	3.40
February	4.91	0.94	4.06	3.14	3.40	5.25	5.72	5.38
March	6.33	3.11	3.04	4.57	3.90	6.54	3.99	1.78
April	4.43	2.47	3.05	4.76	3.57	1.27	1.42	3.42
May	3.99	0.76	4.67	2.29	1.04	4.03	5.92	2.56
June	2.52	5.16	4.18	5.27	1.40	4.67	2.74	4.52
July	3.42	5.26	4.05	5.87	5.56	2.48	3.13	4.89
August	1.20	2.75	3.06	6.95	4.16	2.46	3.16	2.69
September	5.21	1.86	7.83	2.32	2.42	0.78	14.63	2.61
October	1.50	9.15	4.10	0.60	2.83	2.95	2.86	6.34
November	3.40	7.95	4.79	2.95	2.82	5.23	1.61	1.56
December	2.85	1.46	7.63	4.44	2.59	6.18	2.49	3.65

MONTH.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.
January	4.87	5.41	5.42	5.77	5.31	5.05	2.54	9.06
February	5.52	4.44	4.93	6.29	5.02	2.25	4.38	5.71
March	3.99	1.26	3.91	3.72	5.81	1.76	6.09	3.42
April	2.88	2.27	3.84	3.09	2.57	4.45	3.43	3.02
May	3.90	2.09	4.28	0.31	6.04	2.96	5.34	1.39
June	2.52	1.17	3.28	6.79	2.24	3.87	3.97	2.13
July	6.31	5.01	5.31	11.23	2.41	9.77	5.07	.08
August	6.89	6.71	3.09	6.78	6.60	3.78	4.27	5.05
September	0.85	1.10	2.29	1.70	10.00	6.42	6.78	1.97
October	2.92	5.17	2.14	3.56	4.69	3.87	6.73	2.22
November	4.24	5.96	5.39	2.52	4.07	3.54	1.09	3.49
December	6.39	3.08	3.87	5.58	5.93	3.08	3.86	5.86

Total Monthly Precipitation on Croton River Watershed in Inches—(Concluded).

MONTH.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.
January	6.18	3.61	3.22	4.70	1.14	3.49	4.98	3.85
February	1.14	7.43	4.60	1.86	7.27	2.67	4.51	5.43
March	3.61	4.25	1.77	2.12	7.71	3.40	2.90	6.63
April	1.08	3.13	2.83	4.57	1.20	3.01	3.67	1.75
May	5.56	7.88	5.72	2.11	3.08	6.02	7.77	1.90
June	3.54	2.38	1.56	2.35	3.89	3.10	1.41	5.62
July	5.71	2.88	2.68	4.73	4.52	12.49	4.24	5.93
August	0.12	7.13	3.71	4.11	3.84	5.20	11.52	0.64
September	2.25	2.56	6.70	1.32	5.39	1.82	2.24	7.19
October	0.93	5.39	5.72	3.64	2.31	1.25	4.83	1.27
November	7.12	3.13	4.63	4.58	3.57	5.69	6.29	1.91
December	1.04	5.10	4.19	4.49	1.98	4.98	3.04	2.49

Percentage of Water Surface in Croton Watershed.

DATE.	Area, square miles.	Per cent.
1868 to 1873	5.8	1.73
1873 to October 1878	6.2	1.83
1878 to 1891	6.9	2.03
1891 to 1893	8.4	2.48
1893 to 1895	9.5	2.82
1895 to 1897	11	3.28
1897 to 1900	12	3.56

Relation of Annual Precipitation to Run-off on Croton Watershed.

[Drainage area, 338.8 square Miles]

	Rainfall in inches.	Run-off in inches.	Difference or evaporation, inches.	Run-off as a percentage of rainfall.
1868	50.33	33.33	17.00	66.22
1869	48.36	23.61	24.75	48.82
1870	44.63	19.20	25.43	43.02
1871	48.94	19.46	29.48	39.76
1872	40.74	16.92	23.82	41.53
1873	43.87	25.02	18.85	57.03
1874	42.37	25.10	17.27	59.24
1875	43.66	24.77	18.89	56.73
1876	40.68	21.09	19 59	51.84
1877	48.23	20.22	28.01	41.92
1878	55.70	27.17	28.53	48.78
1879	47.04	19.65	27.39	41.77
1880	36.92	12.63	24.29	34.21
1881	46.69	19.25	27.44	41.23
1882	52.35	24.28	28.07	46.38
1883	42.70	13.33	29.37	31.22
1884	51.28	24.08	27.20	46.96
1885	43 67	17.71	25.96	40.55
1886	47.74	20.10	27.64	42.10
1887	57.29	26.61	30.68	46.45
1888	60 69	35.27	25.42	58.12
1889	55.70	31.39	24.31	56 36
1890	54.05	25.95	28.10	48.01
1891	47.20	23.48	23.72	49.75
1892	44.28	17.68	26 60	39.93
1893	54.87	29.05	25.82	52.94
1894	47.33	20.56	26.77	43.44
1895	40.58	15.95	24.63	39.31
1896	45 85	23.26	22.59	50.73
1897	53.12	25 59	27.53	48.17
1898	57.40	29 72	27.68	51.77
1899	44.67	22.28	22.39	49.88
1900	....	....	....	....
1901	....	....	....	....

TEN-MILE RIVER BELOW DOVER PLAINS, DUTCHESS COUNTY, N. Y.

This stream is tributary to Housatonic River below Gaylordsville, Conn. A meter station was established September 16, 1901, by A. E. Place, at Tabor's Bridge which crosses Ten-Mile River about 2,000 feet below the point of inflow of Swamp River. The gauging station is situated about two miles below Dover Plains Village. Its location may be seen on the Clove Sheet of the Topographic Atlas of the United States Geological Survey.

Tabor's Bridge consists of a single span 85 feet between abutments. The bridge stands squarely across the stream, the bed of which is sand and gravel. The entire flow passes between the abutments of this bridge except at the time of extreme high water of nearly every spring, when the river overflows its bank and some water passes around one end of the bridge. During extreme low water, measurements may be made by wading, a short distance below the inflow of Swamp River. A 13-foot boxed weight and wire gauge was attached to foot plates bolted to horizontal chords of the bridge in the first panel from the right-hand end of the upstream side. The water stage is observed twice daily, morning and evening, by the gauge reader, J. J. O'Brien. The bench mark is an oval chisel draft near the bridge seat of the right-hand truss on the upstream side of the abutment.

Elevation of bench mark..........................	100.00
Elevation of water surface when gauge reads zero...	83.80

The tributary watershed of Ten Mile River lies almost wholly in New York State. The drainage area, above the proposed dam site, one-half mile above Webatuck Village, is estimated by John R. Freeman at 200 square miles. An area of 5.5 square miles intervenes between this dam site and the gauging station. The drainage area above the gauging station is 195 square miles.

Current Meter Discharge Measurements of Ten Mile River, at Tabor's Bridge, Below Dover Plains, Dutchess County, N. Y.

DATE.	Gauge height, feet.	Discharge, second-feet.	Hydrographer.
1901.			
September 16	5.27	245.4	A. E. Place.
September 28	4.36	70.8	W. W. Schlecht.
November 11	4.75	121.5	" "
November 22	4.76	128.4	" "
November 22	4.76	120.9	" "
November 6	4.88	140.1	" "
October 26	5.01	187.6	" "
December 27	6.54	554.0	" "
October 15	7.19	692.8	" "
December 17	8.41	1,218.4	" "

In addition to the above discharge measurements, a gauging of Swamp River was made by A. E. Place and R. E. Horton, just above its mouth, September 17, 1901, showing the volume of flow to be 38 second-feet, the gauge height being 5.9 feet.

Two measurements of Ten Mile River at Webatuck, Dutchess County, N. Y., were made by E. G. Paul in 1900 as follows:

August 9.—Discharge, 46 second-feet.

October 20.—Discharge, 32 second-feet.

Water is diverted from a small tributary of Ten Mile River at the so-called Seven Wells, one mile above the gauging station, for the supply of the village of Dover Plains. The amount of diversion is very small.

Before the decline in prices of wrought iron, water power for blowing small iron furnaces was utilized at a number of points in the Ten Mile River drainage area.

WATER PRIVILEGES ON TEN MILE RIVER AND TRIBUTARIES.[a]

Number.	Description.
1.	At State line, abandoned about twenty-five years ago.
2.	At Webatuck Saw Mill, abandoned about eight years ago.
3.	Grist Mill at South Dover, 200 square miles watershed. 9 feet average fall, 75 to 100 horse power.
4.	Dover Furnace, on Swamp River, abandoned about forty years ago.
5.	Dover Furnace, on brook leading into Swamp River. abandoned about thirty years ago.
6.	Dover Plains, Winant's dam, rough block-stone and timber crib construction, 8-foot fall, 134 square miles watershed, affords power to electric light plant and grist mill, average perhaps 100 horse power.
7.	Steel Works Settlement, Amenia township, grist mill abandoned five years ago.
8.	Singpak, Amenia township, abandoned thirty years ago.
9.	South Amenia, grist mill, 8-foot fall, 80 square miles watershed, 20 or 30 horsepower.

Daily Gauge Height of Ten Mile River at Dover Plains, Dutchess County, N. Y.

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1	......	......	......	......	......	......	......	......	......	5.02½	4.95	4.65
2	......	......	......	......	......	......	......	......	......	4.8	4.9	4.67
3	......	......	......	......	......	......	......	......	......	5.0	4.9	4.95
4	......	......	......	......	......	......	......	......	......	5.0	4.85	5.5
5	......	......	......	......	......	......	......	......	......	4.87½	4.57	6.05
6	......	......	......	......	......	......	......	......	......	4.85	4.87	5.4
7	......	......	......	......	......	......	......	......	......	4.75	4.85	5.02
8	......	......	......	......	......	......	......	......	......	4.65	4.8	4.8
9	......	......	......	......	......	......	......	......	......	4.65	4.77	4.77
10	......	......	......	......	......	......	......	......	......	4.65	4.75	6.35
11	......	......	......	......	......	......	......	......	......	4.65	4.67	6.72
12	......	......	......	......	......	......	......	......	......	4.65	4.97	6.85
13	......	......	......	......	......	......	......	......	......	4.57½	5.9	6.12
14	......	......	......	......	......	......	......	......	......	6.27½	5.5	6.47
15	......	......	......	......	......	......	......	......	......	6.82½	5.27	11.17
16	......	......	......	......	......	......	......	......	......	6.42½	5.1	9.5
17	......	......	......	......	......	......	......	......	5.0	6.17½	5.05	8.15
18	......	......	......	......	......	......	......	......	5.2	5.87½	5.9	7.2
19	......	......	......	......	......	......	......	......	5.0	5.62½	4.87	6.85
20	......	......	......	......	......	......	......	......	4.85	5.5	4.87	6.35
21	......	......	......	......	......	......	......	......	4.8	5.47½	4.85	5.95
22	......	......	......	......	......	......	......	......	4.8	5.4	4.79	5.73
23	......	......	......	......	......	......	......	......	4.7	5.35	4.75	5.92
24	......	......	......	......	......	......	......	......	4.6	5.27½	4.75	5.9
25	......	......	......	......	......	......	......	......	4.57½	5.2	5.2	5.85
26	......	......	......	......	......	......	......	......	4.5	5.0	5.1	6.4
27	......	......	......	......	......	......	......	......	4.55	5.02½	4.9	6.47
28	......	......	......	......	......	......	......	......	4.87½	5.05	4.95	6.5
29	......	......	......	......	......	......	......	......	4.77½	4.97½	4.85	10.7
30	......	......	......	......	......	......	......	......	5.5	4.95	4.72	12.2
31	......	......	......	......	......	......	......	......	......	4.92½	......	10.28

a Report on New York's Water Supply, by John R. Freeman, 1900, page 898.

HOUSATONIC RIVER AT GAYLORDSVILLE, CONN.

Housatonic River rises in Hancock Mountains, northwestern Berkshire county, Massachusetts. In its course to its outlet in Long Island Sound, it crosses the western end of Connecticut, and nearly the entire width of Massachusetts. It parallels, at a distance of a few miles, the eastern boundary of New York and receives the drainage from a long narrow strip of New York State extending from Hoosic River Watershed nearly to Long Island Sound.

A gauging station was established at Gaylordsville, Conn., by E. G. Paul, October 24, 1900. This station is situated three miles east of the New York State line and two miles below the mouth of Ten Mile River, the principal tributary from New York State. The location of the station may be seen on the New Milford Sheet of the Topographic Atlas of the United States Geological Survey.

Daily river height observations are made by the gauge reader George H. Monroe. The gauge scale is 16 feet in length, divided decimally. It is attached to woodwork on the inside of the covered highway bridge, in a horizontal position. The observations are made by means of a weight suspended by a sash chain running over a pulley at the zero end of the gauge scale.

Owing to unfavorable conditions underneath the bridge, the discharge measurements are made from a cable of 200 feet span placed across the stream one and one-fourth miles below the bridge. The cable is supported on the right bank by timber shears 25 feet high, and is anchored to a large buried rock. On the left bank a sycamore tree serves as a support for the cable which is anchored to the base of a large oak. The cable station is situated at the site of the proposed storage dam for the water supply of Greater New York. The tributary drainage area above the cable is estimated from the United States Geological Survey Maps to be 1,020 square miles.

A number of undeveloped water powers of considerable magnitude exist on the Housatonic River in Connecticut. The principal facts regarding these are given by John R. Freeman as follows:[a]

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[a] Descriptions of Housatonic water powers are given by Freeman in his Report on New York's Water Supply, 1900, pages 398-424; also see The Housatonic River and its Tributaries, by Dwight Porter, Ph. B., 10th U. S. Census, 1880, Vol. 16, Water Power, Part 1, pp. 308-324.

Undeveloped Water Powers on Housatonic River.

LOCATION.	Tributary drainage area, square miles.	Available fall, feet.
Zoar	1,582	50
Little York	1,389	12
Southville	1,219	25
New Bridge	1,206	20
Gaylordsville	993	15
Bull's Bridge	780	30
Kent Furnace	755	8
Swift Bridge	......	15
Cornwall Bridge	......	10

Current Meter Discharge Measurements of Housatonic River at Gaylordsville, Conn.

DATE.	Gauge height, feet.	Discharge, second-feet.	Hydrographer.
October 20, 1900	3.00	303.0	E. G. Paul.
October 24, 1900	3.10	370.0	E. G. Paul.
August 10, 1900	3.25	422.0	E. G Paul.
August 9, 1900	3.30	450.0	E. G. Paul.
August 3, 1901	3.50	549.5	A. E Place.
September 28, 1901	3.78	700.8	W. W. Schlecht.
September 13, 1901	4.00	911.7	A. E. Place.
October 29, 1901	4.05	951.0	W. W. Schlecht.
November 23, 1901	4.11	965.4	W. W. Schlecht.
November 13, 1901	4.82	1,863.7	W. W. Schlecht.
December 28, 1901	5.16	2,520.0	W. W. Schlecht.

MISCELLANEOUS GAUGINGS OF HOUSATONIC RIVER.

For comparison with the current meter measurements at Gaylordsville, the following previous measurements of low water flow of the Housatonic River have been abstracted from the reports from Freeman and Porter cited above. A series of gaugings of Housatonic River at Kent, Connecticut, extending from July to October inclusive, 1878, by Horace Loomis, showed a minimum flow of 260 second-feet from 755 square miles of watershed or 0.34 second foot per square mile. The mean daily flow from May 22 to November 1, 1878, was 460 second-feet.[a]

In connection with the water power at Birmingham, Conn., the minimum observed flow of Housatonic River is stated by Mr. D. S. Brinsdale, Chief Engineer of the Ousatonic Power Company, to be 500 second-feet from a drainage area of 1,580 square miles, or 0.316 second-foot per square mile.

Occasional gaugings during 1881 and 1882 were made by Mr. B. H. Hull, C. E., at New Milford Falls, Connecticut. His

[a] Report of Department of Public Works of New York city for quarter ending June 30, 1878.

Fig. No. 115.—Housatonic River: Bull's Falls at Bull's Bridge, Conn.

gaugings showed the minimum flow during working hours, when pond storage at the various mills was being drawn upon, to be 916 second-feet from 1,088 square miles drainage. The minimum daily flow for twenty-four hours would be less.

Estimated Low Water Flow of Housatonic River at Gaylordsville, Conn.
[Drainage area, 1,020 square miles.]

[a] Discharge exceeds limit of rating curve. [b] No record.

SUSQUEHANNA RIVER DRAINAGE.

CHENANGO RIVER AT BINGHAMTON, BROOME COUNTY, N. Y.

The gauge on this stream is located on the upstream side of the first span from the right bank of Court Street highway bridge in Binghamton.

It consists of a horizontal wooden box containing a scale graduated in feet and tenths to 15.5 feet, secured to the vertical supports of the hand railing by means of U-bolts. At the zero end of the scale is placed a pulley over which passes the weight wire. The bench mark is a circular chisel draft in upstream corner of bridge seat on left-hand abutment.

Elevation of bench mark	100.00
Elevation of water surface when gauge reads zero	65.98

The Court Street Bridge stands squarely across the thread line of the stream, which has a nearly horizontal bed of gravel and small cobblestones, affording a smooth uniform current for gauging. The channel is obstructed by three masonry piers supporting the four spans of the bridge, 79 feet clear width each; the bridge having a total length of 337 feet between abutments. The bridge is situated 2,500 feet above the mouth of Chenango River. A small rift below the bridge cuts off backwater from Susquehanna River at ordinary stages of the rivers. During freshets, when the gauge reading may be affected by backwater, making them appear too large, check readings are taken at De Forest Street Bridge 1.4 miles upstream.

During the present year, nine current meter measurements have been made through the co-operation of E. C. Murphy.

DATE.	Gauge height, feet.	Discharge, second-feet.
1901.		
July 29	5.21	405
July 29	5.21	425
August 19	5.48	566
August 19	5.49	577
July 2	5.64	848
July 9	5.71	943
July 8	5.78	1,119
October 19	5.81	[illegible]
October 19	5.82	[illegible]

a Subject to revision.

The gauge reader, Mr. E. F. Weeks, takes readings of the river stage twice daily. During freshets additional readings are taken at frequent intervals at the Chenango and Susquehanna stations by the United States Weather Bureau, of which Mr. W. E. Donalson is official in charge at Binghamton.

Three-fourths mile above the gauge is located the dam of the Binghamton Cold Storage Company. Six water wheels are used under a head of zero to 5 feet, rated at a total of 150 horse power. The dam is a low structure giving but 3 feet fall. It consists of large blocks of bluestone laid dry, offering numerous leaks and crevices. The dam affords little obstruction to the flow of the stream, which passes the gauge in nearly its normal regimen.[a]

The flow at Binghamton does not represent the entire natural run-off of the Chenango Watershed, as a portion of the head-waters are diverted across the Chenango-Mohawk divide through Oriskany Creek, to feed the Rome or summit level of Erie Canal.[b]

Low Water Flow on Chenango River at Binghamton, Broome County, N. Y., in Second-feet.
[Drainage area, 1,582 square miles.]

DAY.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1	......	......	......	......	......	......	......	400	700	930	540	......
2	......	......	......	......	......	......	......	400	1,050	590	480	......
3	......	......	......	......	......	......	......	400	700	610	420	......
4	......	......	......	......	......	......	......	400	590	880	420	......
5	......	......	......	......	......	......	......	400	520	650	420	......
6	......	......	......	......	......	......	......	410	420	600	420	......
7	......	......	......	......	......	......	......	400	410	540	420	......
8	......	......	......	......	......	......	......	400	410	560	410	......
9	......	......	......	......	......	......	......	410	400	490	410	......
10	......	......	......	......	......	......	......	410	400	470	410	......
11	......	......	......	......	......	......	......	410	400	450	400	......
12	......	......	......	......	......	......	......	410	400	450	420	......
13	......	......	......	......	......	......	......	410	430	510	......	......
14	......	......	......	......	......	......	......	400	560	560	*	......
15	......	......	......	......	......	......	......	400	460	*	*	......
16	......	......	......	......	......	......	......	*	520	*	*	......
17	......	......	......	......	......	......	......	1,460	660	1,420	......	......
18	......	......	......	......	......	......	......	740	790	1,810	......	......
19	......	......	......	......	......	......	......	560	660	1,180	......	......
20	......	......	......	......	......	......	......	490	540	1,240	......	......
21	......	......	......	......	......	......	......	660	540	1,120	......	......
22	......	......	......	......	......	......	......	700	430	1,050	......	......
23	......	......	......	......	......	......	......	560	410	930	......	......
24	......	......	......	......	......	......	......	*	410	860	......	......
25	......	......	......	......	......	......	......	*	420	690	......	......
26	......	......	......	......	......	......	......	830	410	580	......	......
27	......	......	......	......	......	......	......	470	420	540	......	......
28	......	......	......	......	......	......	......	430	......	480	......	......
29	......	......	......	......	......	......	......	420	400	490	......	......
30	......	......	......	......	......	......	......	410	1,380	460	......	......
31	......	......	......	......	......	......	......	410	......	490	......	......
Mean	......	......	......	......	......	......	......	507	546	682	......	......

[a] See description of Chenango River in Report on Water Power, Pt. 1, 10th U. S. Census, 1880, Vol. XVI, pp. 583–585.
[b] See description of Oriskany Creek Station, p. 443.
* Exceeds limit of rating curve.

Additional diversion takes place from the headwaters of Tioughnioga River through Fayetteville feeder. De Ruyter Reservoir, at the head of the feeder, which has a tributary drainage of 18 square miles, receives most of its supply from across the Chenango divide.

NOMINAL AND EFFECTIVE DRAINAGE AREAS OF CHENANGO RIVER ABOVE BINGHAMTON.

Natural drainage area above Binghamton... 1,582 square miles
Area tributary to canal storage reservoirs.. 105 square miles
Effective area above Binghamton during navigation season .... 1,477 square miles

Mean Monthly Flow of Chenango River at Binghamton, Broome County, N. Y., Low Water Season of 1901.

[Drainage area, 1,582 square miles.]

MONTH.	Second-feet.	Second-feet per square mile.	Inches on drainage area.
August	507	0.32	0.37
September	546	0.34	0.38
October	582	0.37	0.43
November	....	....	....
December	....	....	....

SUSQUEHANNA RIVER AT BINGHAMTON, BROOME COUNTY, N. Y.

A gauging station was established on this stream July 31, 1901. The gauge is located on the upstream side of the left span of the Washington Street Highway bridge. This bridge is situated about 800 feet upstream from the junction of Chenango and Susquehanna Rivers. A rift extends diagonally across the stream, underneath the bridge. The gauge stands above a stretch of smooth water extending from the crest of the rift to the dam, 2,800 feet upstream, and the gauge readings are unaffected by backwater from Chenango River at ordinary stages. Owing to unfavorable conditions underneath the Wash-

ington Street bridge, discharge measurements are made at Exchange Street bridge, 1,900 feet upstream. The gauge is of the weight and wire variety, reading to feet and tenths. Its datum being determined as follows:

Bench mark, chisel draft on corner left-hand bridge abutment, upstream side, elevation..............	100.00
Elevation water surface, when gauge reads zero...	75.88

Current meter measurements were made during 1901 by E. C. Murphy, as follows:

DATE.	Gauge height, feet.	Discharge, second-feet.
1901.		
July 30	2.40	608
August 20	2.50	942
August 20	2.51	952
July 8	2.53	947
July 10	2.76	1,425
August 23	3.05	2,176
August 22	3.35	2,983
August 22	3.64	3,752
August 21	5.05	7,244

By plotting the above discharges as absissae, using the gauge heights as ordinates, a rating curve for the stream cross section at Binghamton has been prepared, from which the mean daily flow in second-feet has been determined from the mean daily gauge height. The gauge is read twice daily by Mr. E. F. Weeks.

There are no tributaries of noticeable magnitude entering between the gauging stations on the Chenango and Susquehanna Rivers at Binghamton and the junction of the two streams. Simultaneous discharge measurements of the two streams were made on several occasions. By combining the volumes of flow of the two branches, that of the Susquehanna below the junction at Binghamton has been obtained as follows:[a]

[a] See description, Chenango River, p. 602.

DATE.	Total flow below junction, second-feet.
1901.	
July 2-3	1,736
July 8-10	2,544
July 29-30	1,013
August 19-20	1,519
August 19-20	1,518

The drainage area of the Susquehanna above Binghamton has been estimated as below:

Drainage Areas of Susquehanna and Chenango Rivers.

LOCATION.	Square miles.
Susquehanna above Oneonta	648
Susquehanna above mouth Unadilla River	914
Unadilla River above junction with Susquehanna	565
Susquehanna River below mouth Unadilla River	1,479
Susquehanna River, total drainage in New York above Chenango River	1,900
Susquehanna River drainage in Pennsylvania above Chenango River	500
Susquehanna River, total above Chenango River	2,400
Chenango River above Chenango Forks	694
Tioughnioga River above junction with Chenango River	753
Chenango River below mouth Tioughnioga River	1,447
Chenango River above mouth	1,582
Susquehanna River below junction of Chenango River	3,982

The Susquehanna gauge is located a short distance below the Binghamton Water Power dam, and the record shows the amount passed by the turbines or wasting over spillway each day. The dam was built in 1833 by Whitney and Waterman. In 1869 it was repaired and its crest raised by the State of New York, and it now furnishes water power to four mills under an effective head of 6 feet.[a]

Water Power Privileges at Susquehanna River Dam, Binghamton, Broome County, N. Y.

FIRM.	Business.	Water rights, etc.
H. J. Lyons Sons	Saw and plaining mill	First privilege, unlimited
Luke Doolittle	Custom grinding	For one reaction water wheel.
Binghamton Box Co	Cigar boxes	Specified number of square inches.
Wilkerson Mfg. Co.	Novelty works	Specified number of square inches.

a For description Susquehanna River Water Power, see Report on Water Power, Pt. 1, 10th U. S. Census, vol. XVI., pp. 577-583.

By taking levels of high water marks furnished by the mill owners, the following data relative to flood discharge of Susquehanna River has been obtained.

DATE.	Depth on crest of present dam.	Estimated discharge second-feet.
March, 1865	12.8	....
Highest since 1865	9.0	41,000
1898 and 1899	8.5	88,000
1901	7.4	86,000

Gauging stations of United States Geological Survey are located on Susquehanna River below Binghamton as follows:[a]

LOCATION OF STATION.	Date when established.	
East Branch Susquehanna River at Binghamton, N. Y.	July 31,	1901.
East Branch Susquehanna River at Danville, Pa.	March 25,	1899.
West Branch Susquehanna River at Allentown, Pa.	March 28,	1899.
Juniata River at Newport, Pa	March 21,	1899.
Susquehanna River at Harrisburg, Pa.	———	1890.

Daily Gauge Height of Susquehanna River at Binghamton, Broome County, N. Y.

[a] For results of gaugings, see Annual Reports and Water Supply and Irrigation Papers, U. S. Geol. Survey.

INQUIRIES REGARDING WATER POWERS OF NEW YORK STATE.

The State Engineer Department of New York is frequently called upon from other States and from other Countries for information regarding water-power development within the State. During the past year a number of such inquiries have been received and among them one from Mr. E. A. Cullen, Chief Engineer of Marine Department of Queensland, Australia, asking details as to the Niagara Falls power development, and another from the Italian Amassador, through the Secretary of State at Washington and through the Governor of New York, asking similar information regarding the part taken by the State in the development of Niagara power.

The correspondence and the reply are given herewith as being of interest in showing how the remarkable natural features of New York State attract attention from other countries, indicating the wisdom of the recent action of the State in undertaking the work of cooperation with the United States Geological Survey in measuring the flow of water in the streams of the State; the value of the records thus obtained being much in excess of the sum of fifteen hundred dollars which the State has appropriated for the purpose, since these records are in constant demand by those who wish to develop the idle water-powers which exist on nearly all of the streams of New York State.

STATE OF NEW YORK,
EXECUTIVE CHAMBER

ALBANY, *April* 18, 1901.

HON. E. A. BOND, *State Engineer and Surveyor, Albany, N. Y.:*

My Dear Mr. Bond.—I enclose herewith a letter from Secretary of State Hay, enclosing a letter from the Italian Ambassador requesting certain information concerning the waterfalls

in this State. Will you kindly give what information you can on the subject.

B. B. ODELL, JR.

(Enclosures.)

(Copy.)

DEPARTMENT OF STATE,
WASHINGTON, *April* 17, 1901.

His Excellency the Governor of New York, Albany, N. Y.:

Sir.—I have the honor to ask whether you can furnish the Department with any information relating to power derived from waterfalls, especially that of Niagara, such as is called for by the note of the Italian Ambassador, copy of which I enclose.

Similar letters have been addressed to the United States Commissioner of Labor and the Director of the United States Census.

I have the honor to be, Sir,

Your obedient servant,
(Signed) JOHN HAY.

Enclosure:

From Italian Ambassador, April 12, 1901.

EMBASSY OF THE KING OF ITALY.

(Copy.)

[TRANSLATION.]

WASHINGTON, *April* 12, 1901.

Mr. Secretary of State:

The Royal Ministry of Public Works is carrying out investigations about the price at which the power derived from waterfalls of rivers and torrents expressed in horse power is farmed-out for industrial purposes by the several states of Europe and America.

It is therefore desirous of securing information on this point and also in regard to the price at which the motive power is in turn sold by the respective grantees for the use of the private establishments.

It especially wants to know whether the waters of the Niagara are monopolized by the State and whether the latter actually sells the power that can be derived therefrom at the rate of lire 95 (about $18) per horse power and per annum.

I should be thankful to your Excellency if you could and would supply me with the desired information, or address me to the source where it can be had.

Be pleased to accept, etc.

(Signed) FAVA.

THE NIAGARA FALLS POWER COMPANY.

D. O. MILLS, PRESIDENT.
EDWARD A. WICKES, FIRST VICE-PRESIDENT.
WILLIAM B. RANKINE, SECOND VICE-PRESIDENT AND TREASURER.
F. L. LOVELACE, SECRETARY.
W. PATTON LITTLE, ASST. SECRETARY AND ASST. TREASURER.

NIAGARA FALLS, N. Y., *May* 11, 1901.

Hon. WILLIAM PIERSON JUDSON, *Deputy State Engineer, State Capitol, Albany, N. Y.:*

Dear Sir.—Your letter of April 20th, addressed to Dr. Coleman Sellers, Chief Engineer of this company, was forwarded by the latter to this office for reply. Please pardon the delay in giving the matter attention, which was occasioned by the absence of the writer from this office.

We are sending you under separate cover what is known as the "Niagara Power Number" of Cassiers' Magazine, a very complete article at the time of its publication, but which is not now up to date with the development made by this company. We also are sending you copy of a recent article by our Electrical Engineer, Mr. H. W. Buck, and which appeared in the May number of the same magazine.

We enclose herewith a printed schedule of the rates at which we sell power in small units to 10-hour users. We also sell 2200 volt, alternating current, furnished continuously for 24 hours per day every day in the year to our tenants in blocks of 1000 E. H. P. at $20 per E. H. P. per annum.

Trusting that these papers will give you the information you desire, and regretting that your letter should not have received earlier attention we are,

Very truly yours,

THE NIAGARA FALLS POWER COMPANY,

(Signed) By W. B. RANKINE,

Second Vice-President.

Enclosure.

STATE OF NEW YORK.
OFFICE OF THE
STATE ENGINEER AND SURVEYOR.
EDWARD A. BOND, STATE ENGINEER.
WILLIAM PIERSON JUDSON, DEPUTY STATE ENGINEER.

ALBANY, *June* 28, 1901.

Hon. B. B. ODELL, *Governor of New York, Albany*, N. Y.:

Sir.—I have the honor to make the following reply to your letter enclosing communication from the Secretary of State at Washington asking that information be furnished for the Italian Ambassador regarding the power derived from water-falls in this State, and especially the power generated at Niagara.

The two largest developments of water power in this State for the generation and transmission of electrical energy, and also the two largest in the world, are those at Niagara, on the Niagara River, 24 miles north from Buffalo, and at Massena, on the St. Lawrence and Grasse Rivers, 95 miles southwest from Montreal.

Application was at once made to the officials of these companies for the latest information regarding their respective plants, and the present reply has been delayed in expectation of receiving more detailed information regarding the development at Massena.

The development of power at Niagara by the Niagara Falls Power Company is fully described in two publications which were obtained by courtesy of the Niagara Falls Power Company and which are sent herewith. The larger one, the "Niagara Power Number" of Cassiers' Magazine, was published in 1895,

and is long since out of sale. The other is a briefer article published in the same magazine in May, 1901.

This plant is unique in its hydraulic installation in that the water from the upper level of the Niagara River, above the great falls, is taken directly to turbine wheels working in a wheel-pit 180 feet deep, excavated in the solid rock (each of which wheels receives 430 cubic feet of water per second under 136 feet head), and that the discharge from the wheels is taken to the lower level of the Niagara River below the falls through a tunnel in which the full flow is at a rate of about 20 miles per hour. This is a very effective, but a very costly, manner of accomplishing the desired result, and its capacity is limited to 100,000 H. P. This plant was also unique when built, as to the size and output of its dynamos, but these have since been equalled elsewhere.

Special features of this plant are the manner of carrying the weight of the 140-foot vertical shafts, and also the governors which automatically adjust the flow of water in each flume to the electrical load upon the direct-connected dynamos.

This company is now generating and delivering to customers 50,000 H. P. and is constructing a duplicate of the plant, which when operated will use the full capacity of the tunnel which serves as the tail-race. When this is operated to its full capacity, it will divert from the Falls about one and one-half per centum of the mean flow of the Niagara River, but will have no perceptible effect upon the appearance of the Falls. The rates at which the power is sold are shown on the accompanying printed list dated July, 1899.

At the same time, the same company is engaged in constructing a similar plant on the Canadian side of the Niagara River, from which it is intended to transmit 15,000 H. P. 80 miles to Toronto for the operation of its street railway and its electric lights.

The present power-plant of this company, on the New York State side of the Niagara River, transmits 17,000 H. P. 24 miles

to Buffalo in a 3-phase current on overhead bare copper wires at 22,000 volts. It also furnishes an equal amount of power to sixteen local manufacturing companies in 2-phase current at 2,200 volts, and 11,500 H. P. to three manufacturies which are two miles distant, in 3-phase current at 11,000 volts. It is not known that there have been any injuries occasioned by the transmission on bare wires of this great amount of current at these high voltages, although the region traversed is thickly settled and there are many people passing on foot and in vehicles, while no special precautions are taken to guard the line.

In addition to this plant above described, there is also in operation at Niagara Falls another electric power company whose equipment is much more simple, being the enlargement of an old surface race-way, or hydraulic canal, which takes water from the upper level of the Niagara River and supplies it by penstocks to a generating electric power station located at the foot of the bank below the Falls, as well as to numerous manufactories and mills, which operate directly by water power, and discharge the water through and over cliffs forming the banks of the lower river. The amount of water thus used is not known to the writer, but it is probably nearly as great as that before described.

The plant at Massena, St. Lawrence County, N. Y., is of interest because of its great size and, also, in that it may be said to be operated by some portion at least of the same water which has already operated the plant already described at Niagara. The water from Niagara passes from the lower Niagara River into Lake Ontario and thence down the St. Lawrence to Massena, where it again passes through the flumes of the Massena Power Company. The effective head at Massena is about 40 feet, being much less than Niagara, but the quantity of water available is greater than at Niagara and is practically unlimited.

The differences in the two plants are very great, owing to the

radically different character of the locations, but the plant at Massena has been built with full knowledge of the methods already in use at Niagara, and improvements in the methods have been made wherever this seemed possible.

The Massena plant is described in full in the illustrated pamphlet which has been obtained by courtesy of the St. Lawrence Power Company, and which is sent herewith. Details as to the commercial rates and use of this power have not been obtained.

The following paragraph occurs in the letter from the Italian Ambassador: "The Royal Ministry of Public Works especially wants to know whether the waters of the Niagara are monopolized by the State and whether the latter actually sells the power that can be derived therefrom." In reply to this it should be said that the Niagara River forms the national boundary line between the United States, as represented by New York State, and the Dominion of Canada, as represented by the Province of Ontario, and that therefore only one-half of the total flow of the Niagara River is the property of the United States, or of New York State. Of this one-half the general government of the United States and the government of New York State freely permit the use of these waters for industrial purposes, and no revenue of any kind is expected or obtained therefrom.

An incorporated company, like the Niagara Falls Power Company, must receive articles of incorporation from the State of New York in the same manner as any other incorporated company without any regard to the fact that it proposes to make use of the water of the Niagara River. The State derives its benefit indirectly from the increased prosperity and from the business which is thus created in the State by the use of its water powers, and all revenue which is derived from the sale of this power goes to the incorporated company, which developes it. The same is true of the great number of other water powers which are similarly used in different parts of the State.

It is hoped that the foregoing will furnish the desired informa-

tion, but if further details are wanted they will gladly be supplied.

Very respectfully,

EDWARD A. BOND,

State Engineer of New York.

Accompanying documents:

Niagara Falls Power Number, Cassiers' Magazine, 384 pages.

Niagara Falls Power Number, Cassiers' Magazine, May 1901, 20 pages.

Rates for metered power, Niagara Falls Power Company, May, 1899, 4 pages.

St. Lawrence Power Company, Massena, N. Y., 1900, 24 pages.

Letter from Second Vice-President Niagara Falls Power Company, May 11, 1901, 2 pages.

Letter from Italian Ambassador April 12, 1901.

Letter from Secretary of State April 17, 1901.

REPORT

ON THE

SPIRIT LEVELS

OF THE

NEW YORK STATE

BARGE CANAL SURVEY

OF

1900 and 1901,

EDWARD A. BOND, State Engineer and Surveyor.

BY

WM. B. LANDRETH, Resident Engineer, Eastern Division N. Y. Canals.

Albany, N. Y., *January* 25, 1902.

Honorable Edward A. Bond, *State Engineer and Surveyor*,
Albany, N. Y.:

Sir.— The following report on the spirit leveling done during the year 1901 on the Barge Canal survey, under chapter 411 of the Laws of 1900 is respectfully submitted.

WM. B. LANDRETH,
Resident Engineer.

HISTORICAL.

The Barge Canal survey of 1900 covered the Erie Canal between Herkimer and one and one-half miles west of New London and between Clyde and Buffalo, and lines of "Y" levels were run on existing canal bench marks between those points. Between New London and Clyde the deep waterway line of levels to Phœnix was used, and a new line run from Phœnix along the Seneca River to Clyde.

From Albany to Phœnix the deep waterway benches were in many instances several miles from the Erie Canal and often many feet below the Erie Canal level, having been placed at convenient points along the proposed line of the deep waterway.

Lines of levels have been run across the State at different times by the State Engineer's Department and (in 1875-1876) by the U. S. Lake survey, and several lists of benches have been published in the reports of the State Engineer. In many instances the older structures have been rebuilt, and the record of the new location and elevation of the benches thereon is open to doubt.

The levels along the Erie Canal on the Eastern, Middle and Western Divisions were not based upon the same datum in the later reports, and on some portions of the line were known to be inaccurate. To obtain a continuous line of accurate levels between Albany and Buffalo for use in future canal improvement I was instructed by you to run a line of "Y" levels over those portions of the Erie Canal that were not covered by the survey of 1900, and on the Champlain Canal from Watervliet to Whitehall.

Work in the field was begun at the old grist mill bench mark at Greenbush March 1, 1901, and completed to Herkimer June 20th. Check lines between the Barge Canal benches on the Seneca River and the old benches on the Erie Canal were run at Syracuse, Peru, Weedsport and Montezuma between June 20th and July 7th. From July 7th to August 17th a portion of the party was employed in

the Albany office working up the results of the field work. A single line of levels was run on the Champlain Canal from Watervliet to Whitehall between August 17th and September 14th, and duplicate lines from New London to Clyde along the Erie Canal between September 16th and December 10th, after which date two of the party took the elevations of the mitre sills of all locks between Herkimer and the Hudson River.

The party was constituted as follows: recorder, instrument-man, two rodmen, and a bubble tender. The chief of the party acted as recorder, or, instrument-man as the necessities of the case required.

Prior to June 20th I was with the field party, afterward spending a day with them from time to time as required. Mr. B. E. Failing was instrument-man to July 7th and in charge of the field party from June 20th to July 17th. Mr. Clark Brown was in charge of the party in the field after August 17th. The remainder of the party at various times has been as follows: Greenbush to Herkimer: rodmen, D. B. La Du and F. L. Fonda; bubble tender, Frank Lutz; Champlain Canal and Erie Canal from New London to Clyde: recorder, D. B. La Du; rodmen, F. L. Fonda and E. B. Hollenbeck; bubble tender, E. G. Hollenbeck.

INSTRUMENT, RODS AND APPLIANCES.

The instrument used was a Gurley "Y" level, purchased in 1900 for the Barge Canal survey. The dimensions of the instrument were:

Focal length	16½ inches.
Clear aperture of objective	1¼ inches.
Magnifying power	35 diameters.
Value of one division of level bubble (measured)	7.04 seconds.
Value of one division of level bubble as given by makers	10 seconds.

DETERMINATION OF ONE DIVISION OF THE LEVEL TUBE.

The value of one division of the level-vial scale has been made by this survey following the methods recommended by Prof. J. B. Johnson[1] as follows:

(1) See Johnson's Surveying, 8th edition, p. 572-3.

Let E_1 = mean of all the eye-end readings of the bubble when it was run to the eye-end of its tube;

Let E_2 = same for bubble at object-end of tube;

Let O_1 = mean of all the object-end readings when bubble was at eye-end of tube.

Let O_2 = same for bubble at object-end of tube;

Let R_1 = mean reading of rod for bubble at eye-end in feet;

Let R_2 = same for bubble at object-end in feet;

Let D = distance from instrument to rod in feet;

Let V = value of one division of the bubble (sine of the angle) at a unit's distance.

Then in seconds of arc we would have:

$$V \text{ (in seconds)} = \frac{R_2 - R_1}{D \sin 1'' \left(\frac{E_1 - O_1}{2} - \frac{E_2 - O_2}{2} \right)}$$

Using the data given by the following observations:

DISTANCE FROM INSTRUMENT TO ROD 100.00 FEET.

SETS.	DIVISION OF SCALE.		Rod reading.
	Object-end.	Eye-end.	
	O	E	
Number 1, bubble eye-end	15	21	3.851
bubble object-end	21	15¼	3.873
Number 2, bubble eye-end	14	22¼	3.850
bubble object-end	22½	14	3.878
Number 3, bubble eye-end	14	23	3.847
bubble object-end	23	14	3.879

We have

$$E_1 = \frac{21 + 22\frac{1}{4} + 23}{3} = 22.08$$

$$E_2 = \frac{15\frac{1}{4} + 14 + 14}{3} = 14.42$$

$$O_1 = \frac{15 + 14 + 14}{3} = 14.33$$

$$O_2 = \frac{21 + 22\frac{1}{2} + 23}{3} = 22.17$$

$$R_1 = \frac{3.851 + 3.850 + 3.847}{3} = 3.8493$$

$$R_2 = \frac{3.873 + 3.878 + 3.879}{3} = 3.8766$$

$D = 100.00$

$\sin 1'' = .000005$

Making the proper substitutions in the above formula we have

$$V = \frac{3.8766 - 3.8493}{100.00 \times .000005\left(\frac{22.08 - 14.33}{2} - \frac{14.42 - 22.17}{2}\right)}$$

and solving

$$V = .0005 \times \frac{.0273}{\left(\frac{7.75}{2} - \frac{-7.75}{2}\right)}$$

$$= \frac{.0273}{.0005 \times \frac{15.50}{2}} = \frac{.0273}{.003875} = 7.04 \text{ seconds.}$$

Namely 1 division of the bubble $=7.04$ seconds of arc.

The rods used were improved Gurley New York rods having a special target and folding disc plumbing level. The face of the target had a black background with a narrow white band along its median horizontal line. The white bands were one-fourth of an inch wide at the outer edges of the target, narrowing down to one-thirty-second of an inch at the center of the face, and allowed a closer setting of the target than the older form of targets.

The rods were divided into feet, tenths and hundredths, and were read to thousandths by a vernier on the target. The foot of the rod was a bronze casting terminating in a truncated pyramid one-half an inch square.

On the levels of 1900 and 1901 nine different rods have been used. Five of these rods have been tested by the U. S. Bureau of Standards, Washington, D. C., two in August, 1901, and three in January, 1902. The two rods, Nos. 1A and 2, used from Albany to Herkimer, from Albany to Whitehall, and from New London to Clyde, were tested in August, 1901, and reported longer than the U. S. Standard, the excessive length, however, being not greater than the changes in length that invariably take place from time to time in a rod of the highest class.

The other three rods tested were used on the Middle Division of the Barge Canal levels in 1900, as follows, No. 1 and No. 2, from Herkimer to the Oneida county line, and No. 3 and No. 4 from the Herkimer county line to New London and from Phœnix to Clyde.

The results of tests are given in table No. 1, and show rods 1, 3 and 4 to be short.

TABLE No. 1.

Corrections to Leveling Rods, Nos. 1A and 2, submitted by State Engineer and Surveyor of New York. Rod No. 1A, at 30° Fahr. Values of spaces reckoned from zero end of rod.

0 to 0.5 feet = + .00017 feet.
0 to 1.5 feet = + .00067 feet.
0 to 2.5 feet = + .00126 feet.
0 to 3.5 feet = + .00174 feet.
0 to 4.5 feet = + .00225 feet.
0 to 5.5 feet = + .00291 feet.
0 to 6.5 feet = + .00350 feet.
0 to 7.5 feet = + .00417 feet.
0 to 8.5 feet = + .00425 feet.
0 to 9.5 feet = + .00459 feet.
0 to 10.5 feet = + .00517 feet.
0 to 11.5 feet = + .00567 feet.
0 to 12.0 feet = + .00600 feet.

Rod No. 2, at 30° Fahr.

0 to 0.5 feet = + .00133 feet.
0 to 1.5 feet = + .00175 feet.
0 to 2.5 feet = + .00217 feet.
0 to 3.5 feet = + .00250 feet.
0 to 4.5 feet = + .00308 feet.
0 to 5.5 feet = + .00341 feet.
0 to 6.5 feet = + .00383 feet.
0 to 7.5 feet = + .00450 feet.
0 to 8.5 feet = + .00467 feet.
0 to 9.5 feet = + .00508 feet.
0 to 10.5 feet = + .00600 feet.
0 to 11.5 feet = + .00642 feet.
0 to 12.0 feet = + .00667 feet.

WASHINGTON, D. C., *August* 2, 1901.

Corrections to Leveling Rods 1, 3 *and* 4 *submitted by the State Engineer and Surveyor, New York. Length at* 70° *Fahrenheit.*

Rod 1.

End of rod to 1 foot	=—0.00017 feet.
End of rod to 4 feet	=—0.00075 feet.
End of rod to 6 feet	=—0.00142 feet.
Extended rod, end of rod to 6.5 feet	=—0.00125 feet.
Extended rod, end of rod to 7 feet	=—0.00142 feet.
Extended rod, end of rod to 9 feet	=—0.00192 feet.
Extended rod, end of rod to 12 feet	=—0.00200 feet.

Rod 3.

End of rod to 1 foot	=—0.00017 feet.
End of rod to 4 feet	=—0.00033 feet.
End of rod to 6 feet	=—0.00092 feet.
End of rod to 6.5 feet	=—0.00108 feet.
Extended rod, end of rod to 7 feet	=—0.00117 feet.
Extended rod, end of rod to 9 feet	=—0.00142 feet.
Extended rod, end of rod to 12 feet	=—0.00142 feet.

Rod 4.

End of rod to 1 foot	=+0.00042 feet.
End of rod to 4 feet	=+0.00008 feet.
End of rod to 6 feet	=—0.00025 feet.
End of rod to 6.5 feet	=—0.00000 feet.
End of rod to 7 feet	=—0.00017 feet.
End of rod to 9 feet	=—0.00033 feet.
End of rod to 12 feet	=—0.00042 feet.

WASHINGTON, D. C., *January* 24, 1902.

The rods used on the Western Division in the levels of 1900 have not been tested at Washington, but have been compared with the tested rods as explained below. The rods used between Clyde and Rochester are marked "W. D. 1" and "W. D. 2," respectively. The rods used from Charlotte to Buffalo are marked "W. D. 3" and "W. D. 4," respectively.

Rod No. 2, tested in August, 1901, has been compared with rod No. 4, tested in January, 1902, by W. and L. E. Gurley, of Troy,

the makers of the rods, and with a standardized tape, and pronounced by them accurate for ten feet length of rod within such small limits as to be observable only by the aid of a magnifying glass.

Both of the rods tested in August, 1901 (Nos. 1A and 2), have been compared with rod No. 4, tested January, 1902, and with a standardized tape by Prof. Lewis Boss, director of the Dudley Observatory at Albany, and Superintendent of Weights and Measures, State of New York, and pronounced by him short at 10 feet, as follows: No. 1, 0.0014 ft., No. 2, 0.001 ft., No. 3, 0.001 ft.

All of the five rods tested in Washington, and the four untested rods, which were used in 1900 on the Western Division of the Barge Canal survey, have been compared one with another by this office force. As careful a comparsion as could be made without a testing machine shows all nine of the rods to be very nearly of the same length at this time, the variations in length appearing not to exceed .001 foot in 10 feet in any case.

The differences in the rods when compared one with another at this time, or, the errors when compared with a standardized tape, do not exceed the differences observed under ordinary conditions between two successive settings of the target at three hundred feet from the instrument. It is practically impossible to determine the actual mean length of the rods when used out of doors for a long period of time under varying conditions of temperature and moisture, and we have no means of determining the lengths of the rods at the particular times when marked changes in altitude were measured, as at Cohoes, Little Falls, Waterford and other places where the locks are close together. Therefore, in view of all the above facts, we have decided to adopt the rods as being correct, and the differences determined in the field have been used without adjustment or change in computing the elevations given in this report.

Steel pins, twelve inches long, one inch square at the top, tapering to a point and having a shoulder three inches long carrying a hardened steel cone were used for turning points. The pin was driven securely in the ground with a mallet, striking on the head, and the rod was held on the hardened steel cone, care being taken not to disturb the pins in any way until all readings were taken. The level was shaded at all times by an umbrella when set up, and

a cloth bag when moving from point to point. A canvas wind breaker, ten feet long and five feet high, was stretched between one and one-half inch gas pipes driven firmly into the ground.

A view of the instrument, rods and other appliances is given in the accompaning photograph taken after the close of the field work.

INSTRUCTIONS.

The instructions for field parties, based on those used for the Barge Canal survey for 1900, but with a smaller error limit, were as follows:

INSTRUCTIONS FOR LEVELING.

1. All lines both forward and backward shall be run with two rodmen.

2. Each rodman shall keep separate notes of rod readings on all turning points and bench marks he holds on and compute the elevations of the same when furnished with the height of instrument by the recorder. Each rodman, when he receives the signal "all right" from the instrument-man, shall at once read the rod and record the reading in the book provided. The recorder shall always read the rod after the rodman, make the necessary calculations and compare the results with the rodman. If the results differ, each shall again read the rod before comparing results, and if the readings of the rod differ, another setting of the target shall be made by the instrument-man.

3. Work must not be attempted during high wind nor when the air is "boiling" badly. During very hot weather an effort should be made to begin work very early and remain out late rather than to work during midday.

4. Foresights and backsights should be of equal length, and no sights over 300 feet shall be taken unless unavoidable circumstances necessitate the same, as in the case of crossing rivers or deep ravines. In such cases extra precautions must be taken and the average of repeated readings at changed positions of rod and instrument taken.

5. If it be impracticable to take equal fore and back sights, as soon as the steep slope or river crossing is passed enough unequal sights shall be taken to make each set balance.

Instrument, rods, umbrella, wind breaker and steel pins used 1900-1901.

6. Distances along railroads may be taken by counting rails; at other times stadia or pacing may be used.

7. The instrument must always be leveled exactly before setting the target. After setting it and before giving the signal "all right" the level bubble must be examined. One rod, No. 1 or No. 2, should always be read first, so that one rod is used as foresight first at one set-up and as backsight first at the next set-up. The bubble tender shall always stand on the same side of the level tube when the reading is made, moving around the tripod as the level tube is reversed.

8. The level must be examined daily or oftener, if necessary, for adjustment, the especially important adjustments being the line of collimation and the level bubble.

9. The steel pegs as furnished must be used as turning points in all cases. These shall be firmly driven in the ground, and the backsight peg shall not be removed until the foresight reading is completed and the recorder and rodman have compared results on the backsight.

10. Plumbing levels must always be used and kept in adjustment.

11. Bench marks or turning points left at the termination of work at night, or for rain or other causes, must be selected with great care and located in such a manner that there will be no danger of their being disturbed or tampered with in order that the rod may again be held on the exact spot.

12. Permanent bench marks shall be clearly described, not only with reference to the nearest base line station but also to existing and easily identified features of the ground. A sketch shall be made showing the location of the bench mark and the reference marks referred to.

13. All circuit closures or checks by duplicate lines shall be distinctly noted and a reference made to the check levels.

Duplicate lines of levels shall be run forward and backward and the error of closure of the two runnings shall fall within .020 feet* $\sqrt{\text{distance in miles between benches}}$ or the lines shall be re-run. Bench marks shall be established at intervals of one-half to one mile.

* After the levels had been run from Albany to Herkimer the results were so good that the limit of error was reduced to .016 $\sqrt{\text{distance in miles between benches}}$.

On the Champlain Canal a single line shall be run from the Erie Canal to Whitehall. The error of closure with the U. S. D. W., shall fall within .050 feet $\sqrt{\text{distance in miles}}$ between the benches, or the lines shall be re-run in the opposite direction.

The number of men in each party shall consist of five: an instrument man, a recorder, two rodmen and an umbrella-man. The instrument must always be shaded from the sun both during the set-ups and in moving from point to point.

PROCEDURE OF WORK.

Starting from a bench or turning point, the instrumentman paced along the towpath from 200 to 250 feet and set up the level, protecting it by the umbrella and wind shield as occasion required.

Rodman No. 1 remained at the bench and rodman No. 2, starting at the same bench, paced to and beyond the instrument till he reached a point as many paces beyond the instrument as the instrument was from rod No. 1, at which point he drove the steel pin.

Having carefully leveled the instrument, the leveler set the target on rod No. 1 as a backsight, and then, avoiding both haste and delay, turned the telescope to rod No. 2 and set the target as a foresight. The bubble tender kept the bubble constantly in the middle of the tube by slight pressure of the fingers on the leveling plate of the instrument. To balance errors due to defective vision of the bubble tender or differences in the light on the bubble, the bubble tender moved around the tripod when the telescope was turned.

The recorder remained with rodman No. 1 until both he and the rodman had read, recorded and checked the rod reading, when he walked rapidly to pin No. 2, checking the paced distances on the way. The recorder then read, recorded and checked the reading of target No. 2 and signaled "all right" to the instrumentman, who repeated the signal to rodman No. 1, when they both moved forward. Rodman No. 1, going to rod No. 2, read, recordered, computed and compared results with rodman No. 2 and the recorder, the leveler having at the same time paced up to point No. 2 to check the pacing and then paced past point No. 2 the proper distance and set up the

Grist Mill Bench-Mark, Greenbush (now Rensselaer) Opposite Albany, N. Y., Photographed 1901.

instrument. Rodman No. 1 paced up to the instrument from point No. 2 and then an equal distance beyond it and drove steel pin and set target. Thus this alternation occurred: First set up, rod No. 1 on backsight is set first and rod No. 2 on foresight is set last; on second set up, rod No. 1 on foresight is set first and rod No. 2 on backsight is set last.

BENCH MARKS.

The initial bench-mark of the survey is that known as the "Grist Mill" bench at Greenbush (now Rensselaer), N. Y. This bench-mark was established by the U. S. Coast and Geodetic Survey in 1857, and is a cross cut in the face of the cellar wall of an old Grist Mill at Greenbush, opposite Albany. Owing to the dilapidated condition of the building and its probable demolition in a few years it was considered advisable to transfer the elevation of the bench to some more permanent point, and this was done by a duplicate line of levels between the Grist Mill bench and the U. S. government bench on the water-table of the Post Office building in Albany. No settlement of the masonry on which the bench is marked seems to have taken place up to this time.

Benches were established on all locks and other permanent canal structures, and wherever possible former benches used by this department, by the U. S. Deep Waterway or by the Coast and the Geodetic Surveys were located, identified and checked upon. Photographs were taken of all benches used between Greenbush and Herkimer, mainly for the purpose of identifying the old benches. A photograph of the Grist Mill bench is reproduced herewith.

The length of line run each day depended almost entirely on the wind and the condition of the atmosphere, and work was stopped when it was found that three or more readings were necessary in order to obtain two readings within two-thousandths foot of each other. The best results were obtained by sights of from 200 to 225 feet. The progress records for the various portions of the survey are given in Table No. 2.

TABLE NO. 2.

Progress Sheet.

DATE.	Days in field.	Miles of single line.	Miles of duplicate line.	Average miles, single line, per day in field.	Cost per mile of double line, fieldwork only.
ERIE CANAL.					
1901. *Greenbush to Herkimer.*					
March 1st to June 20th............	77	248.08	95.43	3.16	$27.79
Grove Spring Road Bridge to Culvert No. 5, East of Clyde.					
September 16th to December 10th.	57	199.18	74.93	3.49	30.99
Tie Lines Between Barge Canal 1900 and Old Canal Benches.					
June 27th to July 5th............	4	12.50	5.75	3.12	28.00
OSWEGO CANAL. *Weigh Lock, Syracuse, to Barge Canal B. M. 60, Seneca River.*					
June 21st to June 26th............	5	16.60	8.00	3.32	19.39
CHAMPLAIN CANAL. *From Lock No. 3, Erie Canal, to Lake Champlain at Whitehall.*					
August 20th to September 14th ...	19½	73.26	*65.10	3.8	†11.12

On the Barge Canal survey of 1900 the average cost per mile in the Middle Division was $25.70 for finished line.

FORMER LINES OF LEVELS.

During the past thirty years several lines of levels have been run across the State and from Albany to Whitehall, by the State and Federal authorities. In 1876 a resurvey of the benches on the several canals was ordered by the State Engineer, and was made under the direction of the Division Engineer on each division. Ordinary "Y" levels were used, but great care was taken in the execution of the work.

The descriptions and elevations of the benches as determined by the 1876 survey have been published in various reports of the State Engineer since the completion of the survey, and as a matter of record an index to those reports is given in table No. 3.

*Finished line. †Single line.

TABLE NO. 3.

Index to Lists of Bench Marks in Reports of State Engineer.

	PAGE
Champlain Canal, Report 1877	115
Champlain Canal, Report 1884	70
Champlain Canal, Report 1888	116
Champlain Canal, Report 1898	185
Glens Falls Feeder, Report 1898	139
Erie Canal, Eastern Division, Report 1877	108
Erie Canal, Eastern Division, Report 1880	83
Erie Canal, Eastern Division, Report 1884	72
Erie Canal, Eastern Division, Report 1888	97
Erie Canal, Eastern Division, Report 1898	122
Erie Canal, Middle Division, Report 1877	155
Erie Canal, Middle Division, Report 1889	201
Erie Canal, Middle Division, Report 1890	250
Erie Canal, Middle Division, Report 1891	342
Erie Canal, Middle Division, Report 1892	224
Erie Canal, Western Division, Report 1877	237
Erie Canal, Western Division, Report 1888	254
Erie Canal, Western Division, Report 1898	269
Oswego Canal, Report 1891	348
Cayuga Canal, Report 1891	353
Cayuga Canal, Report 1892	230
Seneca River, between Cayuga Lake and Cross Lake, Report 1891	356
Benches along Hudson River, Report 1890	300
Benches along Hudson River, Report 1892	270
Black River Canal, description but no elevations, Report 1891	357
Mean tides along Hudson River, Report 1890	308
Mean tides along Hudson River, Report 1892	272
Barge Canal Report 1901	383

Since the survey of 1876 many of the structures upon which the bench marks of that survey were located have been rebuilt, and the action of the frost and other disturbing influences have caused movements in those now existing, making the old elevations unreliable. In future work the former lists of elevations should not be used, but the results of the Barge Canal survey of 1900 and 1901 (given later in this report), being based on recent and more accurate surveys, should replace them.

In 1875 the U. S. Lake Survey ran a duplicate line of levels between the Grist-Mill bench at Greenbush and Oswego, establishing a permanent bench on the cut-stone masonry of the old stone pier by following the Erie Canal from Albany to Higginsville and the Oswego Canal from Phœnix to Oswego. The levels were run by two parties using "Y" levels with sensitive bubbles.

Both parties ran west, the second party following the first and checking on the benches established by them. Whenever the difference between the elevations by the two parties on the same

bench connected [illegible] lines of [illegible] between benches the lines were [illegible].

From Oswego the U. S. Lake Survey levels were carried by the water level of Lake Ontario to Port Dalhousie at the foot of the Welland Canal, based on gauges at Oswego, Charlotte and Port Dalhousie.

From Port Dalhousie, double lines of spirit levels were run to Port Colborne on Lake Erie, thus completing a line of levels from the Hudson River to Lake Erie.

The difference at Oswego between the two lines of the 187[illegible] series of the U. S. Lake Survey was [illegible] feet, and the later records of the U. S. Coast and Geodetic Survey give new elevations for the benches of that survey corrected by later lines of levels.[2]

The U. S. Geological Survey[3] in 18[illegible] connected the water level of Lake Erie with the Erie Canal and the 1875 U. S. Lake Survey benches near Cohoes by a line of precise levels following the Erie railroad from Dunkirk to Binghamton, the Delaware and Hudson Canal Co.'s railroad to South Schenectady, and highways and the Erie Canal to lock No. 15 near Cohoes. This line of levels was connected with the Greenbush bench mark by means of the U. S. Lake Survey published elevations between those points.

The U. S. Board of Engineers on Deep Waterways (1898–9) ran duplicate lines of "Y" levels between the Greenbush bench and Oswego, and between West Troy and Whitehall along the Champlain Canal. This survey followed the Erie Canal from Albany to near Rome, then across country to Phoenix and down the Oswego River to Oswego. The Deep Waterway surveys were very carefully made, and furnish a recent line between the Hudson River and Lake Ontario.

The Barge Canal surveys, made under your direction in 1900 and 1901, completes a new line of levels between the Hudson River and Lake Erie, and furnishes another determination of the differences of elevation between the Hudson River and Lake Erie and Lake Champlain.

Elevations of common points of the various surveys are given in Table No. 4 for comparison, and the routes followed by the various surveys are shown on the accompanying map.

1 See Professional Papers U. S. Corps of Engineers No. 24, p. 536, § 2.
2 See Appendix No. 8 U. S. Coast and Geodetic Survey 1898–9, p. 540.
3 See Appendix 20th Rep. U. S. G. S., p. 310.

TABLE NO. 4.

Original Unadjusted Data for Comparisons.

No. of line in this table.	REFERENCE.		Bench mark.	Elevation	Bench mark.	Elevation.	Difference.
			By Canal Survey of 1900 and 1901.				
1	B. M. No.	0	Greenbush	0.000	Lock No. 15	+145.901	+145.901
1½	B. M. No.	0	Greenbush	0.000	Lock No. 1, coping	+2.929	+2.929
2	B. M. No.	25	Lock No. 15	145.901	Lock No. 36	329.388	+183.487
3	B. M. No.	169	Lock No. 36	329.368	Herkimer (No. 187)	374.481	+45.099
4	B. M. No.	244	).	415.586	(. No. 300)	389.134	−26.452
5	B. M. No.	300	ck	389.154	. 369)	383.371	−5.783
6	B. M. No.	369		383.371	No. 372)	376.216	−7.155
7	B. M. No.	187		374.481		404.621	+30.140
8	B. M. No.	203		404.621	244)	415.586	+10.965
9	B. M. No.	53		344.329	No. 372)	376.216	+31.887
10	B. M. No.	372	)	376.216		500.523	+124.307
11	B. M. No.	459		500.522		269.274	−231.248
12	B. M. No.	459		500.522	M. 547)	562.840	+62.318
12½	B. M. No.	4A		2.929	M. 547)	562.840	+559.911
	Miles from Greenbush.		*By U. S. D. W. Survey.*				
13		0.00	Greenbush	0.000	Lock No. 15	146.000	+146.000
14		10.76	Lock No. 15	146.000	Lock No. 36	329.570	+183.570
15		82.51	Lock No. 36	329.570	Herkimer	374.680	+45.110
16		96.39	Herkimer	374.680	Frankfort	404.850	+30.170
17		101.66	Frankfort	404.850	Phoenix	344.260	−60.590
18		173.34	Phoenix	344.260	Oswego (194.92)	238.120	−106.140
	Page.		*By U. S. L. S.—(levels of 1875).*				
19	Prof. Pa. No. 24,	610		14.730	Lock No. 15 (8A).	160.492	+145.762
20	" "	610		160.492	Lock No. 36 (B. M. 37)	343.967	+183.475
21	" "	612	)	343.967	Frankfort (B. M. 41)	419.242	+75.275
22	" "	618		419.242	Oswego ("A") page 209	251.960	−167.282
23	" "	614		251.960		246.610	−5.350
24	" "	609	face)	246.610		333.230	+86.620
25	" "	609	L. Ontario (mean surface)	246.610		584.640	+338.030
26	" "	609	Port Colborne (B. M. Custom House)	584.640		572.860	−11.780

TABLE No. 4—(Concluded).

REFERENCE.		Bench mark.	Elevation.	Bench mark.	Elevation.	Difference.
No. of line in this table.	30th Appendix.	*By U. S. Geological Survey.*				
27	page 310	Lock No. 15	159.501	Dunkirk B. M.	596.450	+436.949
28	page 290	Dunkirk B. M.	[illegible].450	Lake Erie	573.450	— 16.000
	Report 1877.	*Canal Levels* 1876.				
29	page 108	Lock No. 15	150 380		343.244	+192.864
30	page 108	Lock No. 58	343.244		402.708	+ 59.464
31	page 156	Syracuse Weigh Lock	402.708	87)	396.939	— 5.769
32	page 244	Black Rock Guard Lock	575.677	page 308)	571.680	— 3.997
33	page 108	Lock No. 1	16.115		575.677	+559.562
34	page 108	Lock No. 1	16 115		571.680	+555.565

DATUM PLANE OF CANAL SURVEY OF 1876.

The datum of the 1876 canal levels was mean low tide in the Hudson River at Albany, and its elevation above mean tide at Sandy Hook has been given different values by the various federal departments.

In 1875 the U. S. Engineers[3] determined the difference as 1.18 feet, but in 1896 the U. S. Deep Waterway Commission[1] deduced a value of 1.30 feet therefor. The U. S. Geological Survey[2] has accepted the value of 1.18 feet, and used it in deducing the elevations of their benches.

The State Engineer in 1888[3] accepted the datum of the 1876 canal surveys as being 7.443 feet above the lower miter sill of Erie Canal lock No. 1, or, in other words, the lower miter sill was taken as 7.443 below mean low tide at Albany. The elevation of the lower miter sill of lock No. 1, as determined by the survey of 1901 by duplicate lines from the Greenbush bench, is 6.198 below mean tide at Sandy Hook, making the difference of datum between the canal survey of 1876 and this survey, 7.443—6.198=1.245 feet, which may be taken as 1.25 feet for convenience.

To reduce elevations of this (1901) survey to the datum of the 1876 canal survey subtract 1.25 feet from those of this survey.

DATUM OF SURVEYS OF 1900 AND 1901.

As all of the government surveys in the vicinity of Albany have taken elevations on the Greenbush bench mark, and to enable comparisons to be made readily between the different surveys, all of the field elevations in the 1901 survey were taken with the Greenbush bench mark as the zero of their datum plane.

In reducing the elevations to sea level at Governor's Island, it becomes necessary to adopt a value above that level for the Greenbush bench, as nearly every former survey gave a different value therefor.

Several lines of levels have been run from various tidal gauges

1 Rep. U. S. D. W. Commission, 1896, p. 72.
2 Appendix to the 19th Annual Report U. S. G. S., p. 208.
3 Report of State Engineer for 1888, p. 97.

to the Greenbush bench, and they are described in many published reports to which reference only need be made.

A discussion of the results of the various lines run to the Greenbush bench is given in the report of the U. S. Deep Waterway Commission, 1896 (p. 70), from which the following table of elevations of that bench has been taken and to which has been added data from later reports, bringing the record up to date:

TABLE No. 5.

Elevations of Greenbush Bench.

Date.	AUTHORITY.	Location of gauge.	Elevation, feet.
1857-8	Mr. J. B. Vose, U. S. Coast and Geodetic Survey.	Governor's Island	15.37
1875	Lieut. J. B. Williard, U. S. Engineers		15.37±0.50
1877	Mr. O. H. Tittman, Coast and Geodetic Survey	Governor's Island	14.728
1889	Deduced from West Shore R. R. levels	Weehawken	16.01
1894	Coast and Geo. Survey (mean of the two following lines)		13.64
1893-5	U. S. Coast and Geo. Survey from Boston	Boston	14.07
1893-5	U. S. Coast and Geo. Survey from Sandy Hook	Sandy Hook	13.22
1898-9	U. S Coast and Geo. Survey, Appendix No. 8, p. 414[1]	From an adjusted net	13.732
1898-9	U. S. Coast and Geo. Survey, Appendix No. 8, p. 540[1]	From an adjusted net	13.577

[1] Appendix 8, U. S. Coast and Geodetic Survey, report 1898-9.

The value 14.73 feet above mean tide at Governor's Island has been adopted as the elevation of the Greenbush bench in this survey for the following reasons:

This elevation was used by the U. S. Lake Survey in determining the elevations of the Great Lakes, and all of its published elevations are based thereon.

This elevation was used by the U. S. Coast and Geodetic Survey in determining the elevation of Lake Champlain, and all of its published elevations prior to 1900 are based thereon.

The U. S. Deep Waterway surveys and the 1900 Barge Canal surveys are based on this elevation, and as any future improvement in water transportation between Lake Erie and the Hudson River is likely to make use of those surveys, it is thought that less confusion will occur by retaining this elevation than by using a later one.

Future determinations of the elevation of the initial bench will undoubtedly fix its true value, when, if desired, the elevations given by this survey can be readily reduced to their true value by making the proper reductions.

BENCH MARKS.

The following tables (Nos. 13–18) contain the descriptions, distance from initial point of survey, elevations above Greenbush and above mean tide at Governor's Island, of the bench marks established by the Barge Canal surveys of 1900 and 1901.

The list of benches between Herkimer and New London and between Clyde and Buffalo are republished from the report of the State Engineer on the Barge Canal of February, 1901, so that all of the Barge Canal benches along the Erie and Champlain Canals may appear in one volume for future use. A list of benches along the Oswego Canal is published based on the levels of 1901, 1900 and the U. S. D. W. Survey.

To the republished list have been added columns giving the elevations based on the survey of 1901, the 1900 values having been based on the U. S. Deep Waterway survey from Greenbush to Herkimer and Phœnix.

ACCURACY OF THE WORK.

Table No. 8 has been prepared to show the differences between the east and west lines of this survey. In that table column 1 gives the serial number of the bench mark; column 2 the distance of the second bench noted in column 1, in miles from Greenbush; columns 3, 4 and 5 the difference between the bench marks as given by the west line, the east line and the mean thereof; column 6 shows the partial excesses obtained by subtracting the difference of elevations as determined by the west line from those determined by the east line; column 7 shows the total excess up to that bench mark, the total excess being the algebraic sum of all of the preceeding partial excesses. In columns 6 and 7 the plus sign denotes that the east line is above the west line, and the minus sign the reverse. Columns 8 and 9 give the value of "C" in the equation error$=$C$\sqrt{}$miles between benches, between successive benches and from the Greenbush bench respectively.

Dividing the line from Greenbush to Buffalo into circuits according to the individual surveys and taking the values of "C" from column 8, as calculated between successive bench marks, as

being the severest test of the accuracy of the work, we have the following table:

TABLE NO. 6.

Circuit number.	Length in miles.	LOCATION.	Person in charge.	Allowable value of "C".	Max. "C".	Times zero occurs.
1	95.42	Greenbush to Herkimer	W. B. Landreth	.020	.016	41
2	12.56	Herkimer—East line Oneida county	E. A. Lamb	.050	.016	2
3	25.74	East line Oneida county to Grove Springs	P. A. Meyer	.050	.045	0*
4	74.93	Grove Spring to culvert east of Clyde	Clark Brown	.016	.016	10
5	56.7	Culvert east of Clyde to Rochester	C. W. Trumbull	.050	.049	6
6	94.19	Rochester to Buffalo	Clark Brown	.050	.038	11

* Min. = 0.001.

TOTAL DIVERGENCE OF LINES.

Column 7 of table No. 8 gives the total divergence of the east and west lines of the Barge Canal surveys as follows:

GREENBUSH TO HERKIMER:

The lines cross at miles 0.75, 10.6, 11.0, 11.20, 11.60, 13.20, 15.20, 22.60, 24.70, 29.50, 29.90, 38.50, 51.20, 54.30, and 54.50. From miles 54.50 to Herkimer, at mile 95.42, the east line is above the west with a maximum divergence of .067 at B. M. 136 and .060 at Herkimer.

HERKIMER TO BUFFALO:

From Herkimer to Buffalo the east line is constantly above the west one with maximum values of .290 at B. M. 413; .289 at B. M. 549; minimum values of .032 at B. M. 371; .120 at B. M. 463, and a final divergence of .267 at the Buffalo light house.

Taking the separate curcuits given in Table No. 8 by themselves and comparing their east and west lines we have the following table of their divergence:

TABLE NO. 7.

Divergence of Lines of Circuits.

CIRCUIT.	Maximum divergence.	Times zero occurs.
1	+.067	15
2	+.014	4
3	+.050	4
4	+.063	4
5	+.193	2
6	+.135	9

LINES RE-RUN.

The length of the lines re-run varied somewhat on the various surveys, owing mainly to their having been run in different seasons of the year, and during the work of 1901 the amounts re-run were: Between Greenbush and Herkimer, 26 per cent; between Grove Spring and Clyde, 30 per cent of the total length of east and west accepted lines.

PROBABLE ERROR.

A generally accepted formula for determining the probable error of a direct and reverse line of levels is

$$\text{Probable error (R)} = \pm\ 0.674\ V$$

$$\text{Where R} = \text{probable error}$$

$$V = \frac{\text{difference between lines}}{2}$$

$$\text{Difference at Buffalo} = .267$$

$$V = \frac{.267}{2} = .134$$

$$R = .674 \times .134 = .0903$$

RODS AND INSTRUMENTS OF SURVEYS USED IN COMPARISON OF RESULTS.

The rods and instruments for the various lines used in the comparisons are described in the reports of these different surveys.

The rods used by the U. S. Geological Survey between Cohoes (Lock 15) and Dunkirk were made by the same makers as the rods used by this survey.

The rods used for the first twenty miles from the Greenbush bench mark on the U. S. D. W. Survey were the ordinary Philadelphia rods, and the results given by them differ by 0.10 in 10.76 miles from the results of this survey, which were carefully checked and re-run because of such disagreements. At the end of about 20 miles the U. S. D. W. survey discarded the Philadelphia rods and adopted new rods which gave results agreeing very closely with those of this survey. The greatest divergence (0.295) occurs near Utica. The difference at the last common B. M. near Phœnix is .069 feet.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Mean elevation of Lake Erie as determined by the Lake Survey, 572.86. Difference in elevation between mean lake surface and the [illegible] bench mark is given (1) by Major [illegible] corps of engineers, U. S. A., in letter of March [illegible] as [illegible] 17.20; [illegible] (2) by a previous determination as published in the report of the U. S. Deep Waterways Commission of [illegible]. The correctness of either of these values still remains in doubt and further investigation is in progress. The former value is used in this report. At Oswego the U. S. Deep Waterways report (1900) shows an error in the Lake Survey line of 0.89. This is corroborated by the work of the Canal Surveys of 1900 and 1901. The corrected value of the bench mark at Buffalo (referred to Greenbush 14.73) as made by a combination of the Deep Waterways and the Lake Survey lines therefore becomes

$$572.86+17.20+0.89=590.95$$

The elevation of the light-house bench mark as made by the N. Y. State Survey of 1876 cannot be determined directly, as no determination was made at that time, but can be obtained as follows:

Elevation of B. M. No. 221 on Black Rock guard lock, about six miles from Buffalo, as made in 1876, is 575.68. To reduce this to Greenbush (14.73) add 1.25 as shown previously in this report.

The difference of elevation between the bench at the guard lock and the light-house bench as determined by the Canal Survey of 1900, is 13.64. The corrected value of the light-house bench-mark as determined by the State Survey of 1876 therefore becomes: 575.68+1.25+13.64=590.57.

The U. S. Geological Survey determination can be compared with the new determined elevation of the light-house bench mark. On account of this line forming part of an adjusted net the following result may be subject to revision, depending on the exact results of the original lines. The elevation of the bench mark on the Nelson block, Dunkirk, as published in the 20th Annual Report of the Geological Survey is 588.235. To obtain the elevation of the light-house bench the following corrections are necessary:

+0.215 to remove the adjustment.

--16.03 to obtain mean elevation of Lake Erie.

+17.20 difference between mean water surface and light-house bench.

+1.38 to reduce to Greenbush (14.73) determined as follows: Elevation of B. M. on Crescent aqueduct by U. S. D. W. is 195.55; by Canal Survey, 1901, is 195.58; average, say, 195.57. Elevation as made by U. S. Geological Survey is 194.15. Difference 1.38.

The value of the light-house bench mark, as determined by the U. S. Geological Survey, therefore becomes

588.235+.215—16.03+17.20+1.38=591.00.

RESULT.

To sum up we have, then, the following values of the bench mark on the light-house at Buffalo all referred to the same datum, viz., Greenbush (14.73):

N. Y. State Canal Surveys of 1900 and 1901	591.21
U. S. Lake and Deep Waterways Surveys, combined	590.95
N. Y. State Canal Survey of 1876	590.57
U. S. Geological Survey	591.00

CONCLUSION.

The men employed on the Barge Canal lines were taken from the State Civil Service list and had no special training in accu-

rate leveling, though the men employed in 1901 nearly all had experience in similar work in 1900.

The instruments used were the regular engineer's levels with sensitive bubbles, but could in no sense be called "precise levels," as the term is used in the government reports. See plate No. 1.

The results are those obtained by men of average ability and carefulness working under rigid instructions with instruments such as may be obtained from any reputable maker, and it should be distinctly understood that no claim is made that the lines run are "precise levels" in the technical sense of the term.

The methods of work were almost identical with the later methods of the U. S. Coast Survey and of the U. S. Geological Survey, but the levels used were inferior to the precise levels used by the latter in the optical power of the telescope, in weight and solidity and of a much lower cost. The results are those obtained with an average leveling party working at a good rate.

Experience gained on the Barge Canal surveys shows the necessity of certain precautions to secure a uniform degree of accuracy. Among them may be cited the following:

1. Before testing the instrument adjustments it should be set in the shade and allowed to remain a few moments, in order to allow all of its parts to come to the same temperature.

2. During bright sunlight the line of sight should not be near the ground, or a fence, stone wall or building, to avoid the action of the heat radiated from them.

3. After the target is set and clamped another careful observation should be made of the contact of the rod with the turning point, the plumbing of the rod and the centering of the instrument bubble before the final acceptance of the target setting.

4. During windy weather the instrument should not be set up in dry sand or dust, as the vibration of the tripod legs causes the fine particles to settle under them, raising the instrument.

5. After the instrument is leveled the observer and bubble tender should stand near it as little as possible, owing to the effect of the heat of their bodies in changing the temperature of parts of the instrument. They should, as far as possible, place their bodies so that their breath will not be blown upon the instrument.

The essentials for obtaining good results are: A good instrument with a sensitive bubble, kept in perfect adjustment; equal back sights and fore sights; protection of the instrument from the direct rays of the sun at all times; cessation of work when bad air or wind do not allow two settings of the target on the same point within .002 of a foot. The chief of the party should be a careful, patient man, who should early learn when to stop work, and his guide should be accuracy first, speed second.

I desire to heartily thank the men associated with me in the surveys for the prompt and efficient manner in which their work has been done, and especially Clark Brown, D. B. La Du and F. L. Fonda for their valuable assistance in the reduction of the field notes and preparation of data given in this report.

TABLE NO. 8.

Results of Levels Between Greenbush and Buffalo, N. Y., Erie Canal.

(1) Bench marks.	(2) Distance from Greenbush.	(3) Difference of Elevation. Line west.	(4) Line east.	(5) Mean.	(6) Partial excess = e.	(7) Total excess = E.	(8) Value of "c" in e = c√miles. Col. 6.	(9) Value of "C" in E = C√miles. Col. 7.
0- 1	0.76	−1.042	−1.045	−1.043	−.003	−.003	.003	.003
1- 2	0.76	+5.613	+5.613	+5.613	.000	−.003	.000	.003
2- 4	1.44	−8.340	−8.339	−8.339	+.001	−.002	.001	.002
4- 5	2.68	+16.087	+16.095	+16.091	+.008	+.006	.007	.004
5- 5A	3.18	−1.184	−1.188	−1.186	−.004	+.002	.006	.001
5A- 6	3.75	+5.024	+5.031	+5.027	+.007	+.009	.009	.005
6- 7	5.03	−4.299	−4.299	−4.299	.000	+.009	.000	.004
7- 8	5.58	+6.431	+6.434	+6.432	+.003	+.012	.004	.005
8- 9	6.18	−5.985	−5.983	−5.984	+.002	+.014	.003	.006
9- 10	6.48	+2.877	+2.878	+2.877	+.001	+.015	.002	.006
10- 11	7.18	−0.659	−0.663	−0.661	−.004	+.011	.005	.004
11- 12	7.30	−7.218	−7.218	−7.218	.000	+.011	.000	.004
11- 13	7.38	−1.553	−1.550	−1.551	+.003	+.014	.007	.005
13- 14	7.96	+10.858	+10.846	+10.852	−.012	+.002	.016	.001
14- 15	8.25	+11.154	+11.158	+11.156	+.004	+.006	.007	.002
15- 16	8.52	+10.781	+10.776	+10.778	−.005	+.001	.010	.000
16- 17	8.73	+10.002	+10.005	+10.003	+.003	+.004	.007	.001
17- 18	8.86	+9.646	+9.647	+9.646	+.001	+.005	.003	.002
18- 19	9.02	+10.250	+10.250	+10.250	.000	+.005	.000	.002
19- 20	9.36	+10.129	+10.135	+10.132	+.006	+.011	.011	.003
20- 21	9.53	+9.948	+9.941	+9.944	−.007	+.004	.002	.001
21- 22	9.69	+10.010	+10.011	+10.010	+.001	+.005	.002	.001
22- 23	9.84	+10.087	+10.090	+10.088	+.003	+.008	.008	.003
23- 24	10.04	+9.896	+9.898	+9.897	+.002	+.010	.004	.003
24- 25	10.26	+9.940	+9.937	+9.938	−.003	+.007	.006	.002
25- 26	10.53	+10.230	+10.223	+10.226	−.007	.000	.013	.000
26- 27	10.53	−0.100	−0.100	−0.100	.000	.000	.000	.000
27- 28	10.72	+9.943	+9.940	+9.941	−.003	−.003	.007	.001
28- 29	11.04	+10.137	+10.141	+10.139	+.004	+.001	.007	.000
29- 30	11.23	+10.284	+10.280	+10.282	−.004	−.003	.009	.001
30- 31	11.50	+0.246	+0.245	+0.245	−.001	−.004	.002	.001
31- 32	11.97	+1.737	+1.746	+1.741	+.009	+.005	.013	.001
32- 33	12.07	−31.412	−31.408	−31.410	+.004	+.009	.012	.003
32- 35	13.34	+0.225	+0.219	+0.222	−.006	−.001	.005	.000
35- 36	13.98	+2.304	+2.300	+2.302	−.004	−.005	.005	.001
36- 37	14.20	−0.092	−0.094	−0.093	−.002	−.007	.004	.002
37- 38	15.47	−3.082	−3.074	−3.078	+.008	+.001	.007	.000
38- 39	15.87	+1.563	+1.563	+1.563	.000	+.001	.000	.000
39- 41	16.62	−1.813	−1.813	−1.813	.000	+.001	.000	.000
41- 42	17.62	+1.092	+1.104	+1.098	+.012	+.013	.012	.003
42- 43	18.00	−0.089	−0.090	−0.089	−.001	+.012	.002	.003
43- 44	18.31	+0.034	+0.020	+0.027	−.014	−.002	.025	.000
44- 45	18.69	−1.491	−1.485	−1.488	+.006	+.004	.010	.001
45- 46	19.44	+0.148	+0.155	+0.151	+.007	+.011	.008	.002
46- 47	19.86	+2.149	+2.140	+2.144	−.009	+.002	.014	.000
47- 48	20.09	+5.483	+5.487	+5.485	+.004	+.006	.008	.001
48- 49	20.96	+4.768	+4.766	+4.767	−.002	+.004	.002	.001
49- 50	22.83	+5.132	+5.127	+5.129	−.005	−.001	.004	.000
50- 51	24.18	+4.272	+4.269	+4.270	−.003	−.004	.003	.001
51- 52	26.05	+8.814	+8.825	+8.819	+.011	+.007	.008	.001
52- 53	26.23	+9.904	+9.906	+9.905	+.002	+.009	.005	.002
53- 54	26.31	+0.903	+0.905	+0.904	+.002	+.011	.002	.002
54- 55	26.43	+3.678	+3.676	+3.677	−.002	+.009	.006	.002
55- 56	26.53	−0.187	−0.187	−0.187	.000	+.009	.000	.002
56- 57	26.60	+34.673	+34.673	+34.673	.000	+.009	.000	.002
56- 59	28.00	−4.520	−4.521	−4.520	−.001	+.008	.000	.002
59- 60	28.22	+1.871	+1.870	+1.870	−.001	+.007	.002	.001
60- 61	28.85	+1.718	+1.717	+1.717	−.001	+.006	.001	.001
61- 62	29.10	−1.874	−1.874	−1.874	.000	+.006	.000	.001
62- 63	29.52	+1.504	+1.500	+1.502	−.004	+.002	.006	.000
63- 64	29.77	+0.593	+0.588	+0.590	−.005	−.003	.010	.001
64- 65	30.11	+5.209	+5.214	+5.211	+.005	+.002	.009	.000
64- 66	30.07	−2.186	−2.179	−2.182	+.007	+.004	.013	.001
66- 67	30.57	+0.007	+0.007	+0.007	.000	+.004	.000	.001
67- 68	30.77	+1.320	+1.319	+1.319	−.001	+.003	.002	.001
68- 69	31.33	−11.042	−11.042	−11.042	.000	+.003	.000	.001
69- 70	32.47	+8.714	+8.716	+8.715	+.002	+.005	.002	.001
70- 71	32.47	+3.081	+3.081	+3.081	.000	+.005	.000	.001
71- 72	33.15	+4.536	+4.541	+4.538	+.005	+.010	.006	.002
72- 73	33.26	+0.660	+0.660	+0.660	.000	+.010	.000	.002
73- 74	33.94	+7.766	+7.760	+7.763	−.006	+.004	.008	.001
74- 75	34.56	+2.572	+2.574	+2.573	+.002	+.006	.003	.001
75- 76	35.18	−1.429	−1.433	−1.431	−.004	+.002	.005	.000
76- 77	35.35	+2.838	+2.839	+2.838	+.001	+.003	.002	.001

TABLE No. 8—(*Continued*).

(1) Bench marks.	(2) Distance from Greenbush.	(3) Difference of Elevation. Line west.	(4) Line east.	(5) Mean.	(6) Partial excess = e.	(7) Total excess = E.	(8) Value of "c" in e = c√miles. Col. 6.	(9) Value of "C" in E = C√miles. Col. 7.
77- 78	36.20	—1.435	—1.434	—1.434	+.001	+.004	.001	.001
78- 79	36.66	—1.161	—1.164	—1.162	—.003	+.001	.004	.000
79- 80	37.61	—1.274	—1.270	—1.272	+.004	+.005	.004	.001
80- 82	37.74	+7.736	+7.738	+7.737	+.002	+.007	.006	.001
82- 83	38.24	+2.405	+2.401	+2.403	—.004	+.003	.006	.000
83- 84	38-66	+0.881	+0.877	+0.879	—.004	—.001	.006	.000
84- 85	39.21	—0.648	—0.653	—0.650	—.005	—.006	.007	.001
85- 86	39.87	+0.892	+0.892	+0.892	.000	—.006	.000	.001
86- 87	42.07	—4.523	—4.520	—4.521	+.003	—.003	.002	.000
87- 88	43.48	+3.640	+3.626	+3.633	—.014	—.017	.012	.003
88- 89	44.12	+5.173	+6.169	+5.171	—.004	—.021	.005	.003
89- 90	44.12	+0.062	+0.062	+0.062	.000	—.021	.000	.003
90- 91	44.32	+7.943	+7.943	+7.943	.000	—.021	.000	.003
91- 92	46.37	+0.341	+0.351	+0.346	+.010	—.011	.007	.002
92- 93	46.86	+7.402	+7.403	+7.402	+.001	—.010	.001	.001
93- 94	47.13	—15.772	—15.772	—15.772	.000	—.010	.000	.001
94- 95	49.54	+16.282	+16.283	+16.282	+.001	—.009	.000	.001
95- 96	51.26	+2.513	+2.522	+2.517	+.009	.000	.007	.000
96- 97	51.26	+0.010	+0.009	+0.009	—.001	—.001	.000	.000
97- 98	51.51	+4.795	+4.798	+4.796	+.003	+.002	.006	.000
98- 99	51.88	+3.203	+3.203	+3.203	.000	+.002	.000	.000
99-100	52.14	+7.441	+7.445	+7.443	+.004	+.006	008	.001
100-101	52.37	+1.068	+1.068	+1.068	.000	+.006	.000	.001
101-102	52.80	+3.317	+3.322	+3.319	+.005	+.011	.007	.001
102-104	53.68	—0.153	—0.156	—0.154	—.003	+.008	.008	.001
104-105	54.04	—1.586	—1.586	—1.586	.000	+.008	.000	.001
105-106	54.04	+2.238	+2.236	+2.237	—.002	+.006	....	.001
106-107	54.40	—2.685	—2.692	—2.688	—.007	—.001	.012	.000
107-109	55.30	+0.192	+0.199	+0.195	+.007	+.006	.007	.001
109-110	55.64	+0.605	+0.605	+0.605	.000	+.006	.000	.001
110-111	55.96	+0.971	+0.970	+0.970	—.001	+.005	.002	.001
111-112	55.96	—3.402	—3.403	—3.402	—.001	+.004	....	.001
112-113	56.45	+2.124	+2.131	+2.127	+.007	+.011	.010	.001
113-114	57.31	+1.437	+1.443	+1.440	+.006	+.017	.006	.002
114-115	57.43	—2.097	—2.097	—2.097	.000	+.017	.000	.002
115-116	58.17	+1.559	+1.563	+1.561	+.004	+.021	.004	.003
116-117	58.87	—1.575	—1.568	—1.571	+.007	+.028	.008	.004
117-118	59.79	—0.566	—0.556	—0.561	+.010	+.038	.010	.005
118-119	59.79	+1.525	+1.526	+1.525	+.001	+.039	....	.005
119-120	60.44	—3.874	—3.870	—3.872	+.004	+.043	.005	.006
120-121	61.34	+2.710	+2.711	+2.710	+.001	+.044	.001	.006
121-122	62.30	—0.174	—0.166	—0.170	+.008	+.052	.008	.007
122-123	62.71	—2.368	—2.367	—2.367	+.001	+.053	.002	.007
123-124	62.71	+0.047	+0.047	+0.047	.000	+.053	.000	.007
124-125	63.82	—0.028	—0.021	—0.024	+.007	+.060	.007	.007
125-126	64.72	+2.358	+2.359	+2.358	+.001	+.061	.001	.008
126-127	65.62	—0.700	—0.695	—0.697	+.005	+.066	.005	.008
127-128	66.00	+4.915	+4.911	+4.913	—.004	+.062	.006	.008
128-129	66.22	+1.503	+1.506	+1.504	+.003	+.065	.006	.008
129-130	66.62	+0.837	+0.837	+0.837	.000	+.065	.000	.008
130-131	67.04	—2.625	—2.627	—2.626	—.002	+.063	.003	.008
131-132	67.04	+1.151	+1.150	+1.150	—.001	+.062	.000	.008
132-133	67.79	—0.978	—0.977	—0.977	+.001	+.063	.001	.008
133-134	68.59	+0.916	+0.912	+0.914	—.004	+.059	.004	.007
134-135	69.17	+3.508	+3.510	+3.509	+.002	+.061	.003	.007
135-136	69.55	—1.688	—1.682	—1.685	+.006	+.067	.010	.008
136-137	69.93	+0.929	+0.927	+0.928	—.002	+.065	.003	.008
137-138	70.63	—1.202	—1.203	—1.202	—.001	+.064	.001	.008
138-139	71.94	—0.619	—0.622	—0.620	—.003	+.061	.003	.007
139-140	71.94	+1.815	+1.815	+1.815	.000	+.061	.000	.007
140-141	72.32	+4.739	+4.739	+4.739	.000	+.061	.000	.007
141-142	73.07	+2.085	+2.081	+2.083	—.004	+.057	.004	.007
142-143	73.47	—1.774	—1.775	—1.774	—.001	+.056	.002	.007
143-144	73.77	+1.278	+1.278	+1.278	.000	+.056	.000	.007
144-145	73.87	—6.146	—6.145	—6.145	+.001	+.057	.003	.007
145-146	74.58	+2.945	+2.938	+2.941	—.007	+.050	.009	.006
146-147	76.28	—0.853	—0.848	—0.850	+.005	+.055	.004	.006
147-148	76.58	+3,326	+3.325	+3.325	—.001	+.054	.002	.006
148-149	76.58	+0.277	+0.277	+0.277	.000	+.054	.000	.006
149-150	77.43	+4.334	+4.327	+4.330	—.007	+.047	.007	.005
150-151	77.71	+1.761	+1.759	+1.760	—.002	+.045	.004	.005
151-152	77.71	—0.020	—0.020	—0.020	.000	+.045	.000	.005
152-153	78.25	+1.342	+1.349	+1.345	+.007	+.052	.009	.006
153-154	79.72	+1.141	+1.138	+1.139	—.003	+.049	.003	.006
154-155	80.00	+3.793	+3.790	+3.791	—.003	+.046	.006	.005

TABLE No. 5—(*Continued*).

(1) Bench marks.	(2) Distance from Green-bush.	(3) Difference of Elevation. Line west.	(4) Line east.	(5) Mean.	(6) Partial excess = e.	(7) Total excess = E.	(8) Value of "c" in e = c√miles. Col. 6.	(9) Value of "C" in E = C√miles Col. 7.
155-156	80.57	+0.097	+0.097	+0.097	.000	+.046	.000	.005
156-157	80.89	+1.854	+1.848	+1.851	—.006	+.040	.011	.004
157-158	80.89	+0.568	+0.567	+0.567	—.001	+.039	.000	.004
158-159	81.19	—0.360	—0.365	—0.362	—.005	+.034	.009	.004
159-160	81.59	+0.958	+0.957	+0.957	—.001	+.033	.002	.004
160-161	82.19	—1.936	—1.934	—1.935	+.002	+.035	.008	.004
161-162	82.72	—0.234	—0.236	—0.235	—.002	+.033	.003	.004
162-163	83-18	+7.213	+7.214	+7.213	+.001	+.034	.001	.004
163-164	83.28	+1.118	+1.117	+1.117	—.001	+.033	.008	.004
164-165	83.61	+1.091	+1.096	+1.093	+.005	+.038	.009	.004
165-166	83.61	+0.070	+0.070	+0.070	.000	+.038	.000	.004
166-167	84.06	+2.471	+2.471	+2.471	.000	+.038	.000	.004
167-168	85.87	—1.728	—1.719	—1.723	+.009	+.047	.007	.005
168-169	87.55	+6.645	+6.658	+6.651	+.013	+.060	.010	.006
169-170	88.17	+10.041	+10.041	+10.041	.000	+.060	.000	.006
170-171	88.33	+9.630	+9.630	+9.630	.000	+.060	.000	.006
171-172	88.55	+10.049	+10.044	+10.046	—.005	+.055	.011	.006
172-173	88.66	+4.302	+4.301	+4.301	—.001	+.054	.003	.006
173-174	89.21	—0.305	—0.298	—0.301	+.007	+.061	.009	.006
174-175	89.76	+0.602	+0.593	+0.597	—.009	+.052	.012	.005
175-176	90.78	+0.579	+0.574	+0.576	—.005	+.047	.005	.005
176-177	90.78	—0.109	—0.110	—0.109	—.001	+.046	.000	.005
177-178	91.31	+2.712	+2.707	+2.709	—.005	+.041	.007	.004
178-179	91.31	+0.106	+0.106	+0.106	.000	+.041	.000	.004
179-180	92.22	+4.190	+4.192	+4.191	+.002	+.043	.002	.005
180-181	92.87	—0.290	—0.291	—0.290	—.001	+.042	.001	.004
181-182	93.29	—0.269	—0.262	—0.265	+.007	+.049	.010	.005
182-183	93.96	+4.447	+4.443	+4.445	—.004	+.045	.005	.005
183-184	94.82	+4.116	+4.120	+4.118	+.004	+.049	.006	.005
184-185	94.82	+0.004	+0.006	+0.005	+.002	+.051	.000	.005
185-186	95.81	+1.196	+1.208	+1.204	+.007	+.058	.007	.006
186-187	95.42	—5.908	—5.906	—5.907	+.002	+.060	.006	.006
187-188	96.43	+3.748	+3.744	+3.746	—.004	+.056	.004	.006
188-189	96.55	+0.819	+0.819	+0.819	.000	+.056	.000	.006
189-190	96.96	—0.304	—0.296	—0.300	+.008	+.064	.012	.007
190-193	97.32	+15.126	+15.124	+15.125	—.002	+.062	.008	.006
193-194	97.68	+2.293	+2.297	+2.295	+.004	+.066	.007	.007
194-195	98.39	—0.985	—0.983	—0.984	+.002	+.068	.002	.007
195-196	98.63	—0.688	—0.687	—0.687	+.001	+.069	.002	.007
196-197	98.91	—0.073	0.073	—0.073	.000	+.069	.000	.007
197-198	99.17	+1.774	+1.777	+1.775	+.003	+.072	.006	.007
198-199	99.60	—1.097	—1.093	—1.095	+.004	+.076	.006	.008
199-201	100.18	+11.129	+11.126	+11.127	—.003	+.073	.004	.007
201-202	100.56	+2.159	+2.155	+2.157	—.004	+.069	.006	.007
202-203	101.18	—3.761	—3.766	—3.763	—.005	+.064	.007	.006
203-204	101.24	+8.611	+8.607	+8.609	—.004	+.060	.012	.006
204-205	101.68	+3.138	+3.133	+3.135	—.005	+.055	.007	.005
205-206	102.15	+0.353	+0.355	+0.354	+.002	+.057	.008	.005
206-207	102.43	—1.368	—1.371	—1.369	—.003	+.054	.006	.005
207-208	102.97	+1.715	+1.723	+1.719	+.008	+.062	.011	.006
208-209	103.56	—0.191	—0.193	—0.192	—.002	+.060	.003	.006
209-210	103.94	—0.904	—0.898	—0.901	+.006	+.066	.010	.006
210-211	104.93	—0.508	—0.507	—0.507	+.001	+.067	.001	.006
211-212	105.33	—1.026	—1.036	—1.031	—.010	+.057	.016	.006
212-213	105.77	+2.510	+2.509	+2.509	—.001	+.056	.001	.005
213-214	106.06	—1.271	—1.272	—1.271	—.001	+.055	.002	.005
214-215	106.88	—2.098	—2.091	—2.094	+.007	+.062	.008	.006
215-216	107.41	+2.485	+2.488	+2.486	+.003	+.065	.004	.006
216-217	107.98	+1.203	+1.202	+1.202	—.001	+.064	.001	.006
217-218	108.88	—5.274	—5.245	—5.259	+.029	+.093	.030	.009
218-219	109.96	+5.384	+5.397	+5.390	+.013	+.106	.011	.010
219-221	110.68	—3.765	—3.779	—3.772	—.014	+.092	.017	.009
221-222	110.98	+3.887	+3.909	+3.898	+.022	+.114	.040	.011
222-224	111.68	+2.544	+2.506	+2.525	—.038	+.076	.045	.007
224-225	112.68	+1.592	+1.607	+1.599	+.015	+.091	.015	.009
225-226	113.28	—0.088	—0.092	—0.090	—.004	+.087	.004	.008
226-227	113.58	—2.067	—2.074	—2.070	—.007	+.080	.012	.007
227-228	114.18	+0.178	+0.192	+0.185	+.014	+.094	.019	.009
228-229	114.58	+1.299	+1.289	+1.294	—.010	+.084	.018	.008
229-230	115.68	+1.623	+1.614	+1.618	—.009	+.075	.008	.007
230-231	116.78	—0.412	—0.440	—0.426	—.028	+.047	.025	.004
231-232	117.28	—2.197	—2.178	—2.187	+.019	+.066	.024	.006
232-233	118.38	+1.871	+1.858	+1.864	—.013	+.053	.013	.005
233-234	118.98	—0.750	—0.742	—0.746	+.008	+.061	.009	.006
234-235	120.28	—0.087	—0.116	—0.101	—.029	+.032	.026	.003

TABLE No. 8—(*Continued*).

(1) Bench marks.	(2) Distance from Greenbush.	(3) Difference of Elevation. Line west.	(4) Line east.	(5) Mean.	(6) Partial excess = e.	(7) Total excess = E.	(8) Value of "c" in e = c√miles. Col. 6.	(9) Value of "C" in E = C√miles. Col. 7.
235.236	121.68	+1.141	+1.142	+1.141	+.001	+.033	.001	.003
236-237	123.58	+1.550	+1.569	+1.559	+.019	+.052	.013	.005
237-238	125.56	—5.124	—5.110	—5.117	+.014	+.066	.009	.006
238-239	126.68	+2.766	+2.748	+2.757	—.018	+.048	.017	.004
239-240	127.86	—0.319	—0.334	—0.326	—.015	+.033	.013	.003
240-241	129.61	+0.505	+0.515	+0.510	+.010	+.043	.008	.004
241-242	131.05	+2.723	+2.711	+2.717	+.012	+.055	.010	.005
242-243	132.40	+2.620	+2.633	+2.626	+.013	+.068	.011	.006
243-244	133.72	—5.846	—5.836	—5.841	+.010	+.078	.008	.007
244-245	134.87	+6.162	+6.159	+6.160	—.003	+.075	.004	.006
245-246	135.17	—0.214	—0.206	—0.210	+.008	+.083	.009	.007
246-247	136.18	—2.133	—2.129	+2.131	+.004	+.087	.004	.007
247-248	136.58	+0.744	+0.745	+0.744	+.001	+.088	.002	.008
248-249	136.85	—5.946	—5.945	—5.945	+.001	+.089	.002	.008
249-250	137.48	+3.818	+3.828	+3.823	+.010	+.099	.012	.008
250-251	137.64	—3.470	—3.471	—3.470	—.001	+.098	.002	.008
251-252	137.98	+0.075	+0.081	+0.078	+.006	+.104	.010	.009
252-253	138.11	+4.013	+4.013	+4.013	.000	+.104	.000	.009
253-254	138.70	+0.071	+0.074	+0.072	+.003	+.107	.004	.009
254-255	139.04	—4.487	—4.492	—4.489	—.005	+.102	.009	.009
255-256	139.74	+0.421	+0.420	+0.420	—.001	+.101	.001	.009
256-257	140.71	+5.219	+5.208	+5.213	—.011	+.090	.011	.008
257-258	140.88	—1.122	—1.122	—1.122	.000	+.090	.000	.008
258-259	141.01	—1.195	—1.198	—1.197	—.003	+.087	.008	.007
259-260	141.16	+1.676	+1.678	+1.677	+.002	+.089	.005	.007
260-261	142.08	+1.067	+1.063	+1.065	—.004	+.085	.004	.007
261-262	142.66	—3.963	—3.964	—3.963	—.001	+.084	.001	.007
262-263	143.78	+1.838	+1.835	+1.836	—.003	+.081	.003	.007
263-264	144.86	—3.962	—3.957	—3.959	+.005	+.086	.005	.007
264-265	145.66	+4.234	+4.230	+4.232	—.004	+.082	.005	.007
265-266	146.05	—1.909	—1.913	—1.911	—.004	+.078	.006	.006
266-267	146.24	+2.648	+2.646	+2.647	—.002	+.076	.005	.006
267-268	146.92	—3.781	—3.775	—3.778	+.006	+.082	.007	.007
268-269	147.80	+3.750	+3.761	+3.755	+.011	+.093	.012	.008
269-270	148.29	+0.254	+0.258	+0.256	+.004	+.097	.006	.008
270-271	148.88	—4.432	—4.427	—4.429	+.005	+.102	.006	.008
271-272	149.75	+4.527	+4.531	+4.529	+.004	+.106	.004	.009
272-273	150.44	—5.341	—5.343	—5.342	—.002	+.104	.002	.009
273-274	150.84	+5.452	+5.453	+5.452	+.001	+.105	.001	.009
274-275	152.39	—1.011	—1.002	—1.006	+.009	+.114	.007	.009
275-276	152.74	—0.310	—0.308	—0.309	—.002	+.112	.003	.009
276-277	152.96	—4.560	—4.558	—4.559	+.002	+.114	.004	.009
277-278	153.61	+5.846	+5.841	+5.843	—.005	+.109	.006	.009
278-279	154.60	+1.279	+1.280	+1.279	+.001	+.110	.001	.009
279-280	155.79	—0.281	—0.278	—0.279	+.003	+.113	.003	.009
280-281	156.94	+0.483	+0.496	+0.489	+.013	+.126	.012	.010
281-282	157.42	—9.376	—9.371	—9.373	+.005	+.131	.007	.010
282-283	157.86	—5.533	—5.531	—5.532	+.002	+.133	.003	.011
283-284	159.94	+12.626	+12.628	+12.627	+.002	+.135	.001	.011
284-285	160.38	+1.547	+1.555	+1.551	+.008	+.143	.012	.011
285-286	160.76	—0.528	—0.530	—0.529	—.002	+.141	.003	.011
286-287	161.32	+1.330	+1.324	+1.327	—.006	+.135	.008	.011
287-288	161.82	—7.081	—7.090	—7.085	—.009	+.126	.013	.010
288-289	162.83	+5.514	+5.502	+5.508	—.012	+.114	.012	.009
289-290	165.04	—0.393	—0.402	—0.397	—.009	+.105	.006	.008
290-291	166.70	—1.877	—1.875	—1.876	+.002	+.107	.002	.008
291-292	166.75	—1.572	—1.572	—1.572	.000	+.107	.000	.008
292-293	167.25	+0.528	+0.536	+0.532	+.008	+.115	.011	.009
293-294	167.44	—10.599	—10.604	—10.601	—.005	+.110	.011	.009
294-295	167.81	—7.309	—7.307	—7.308	+.002	+.112	.003	.009
295-296	168.09	—1.058	—1.056	—1.057	+.002	+.114	.004	.009
296 297	168.15	—1.930	—1.929	—1.929	+.001	+.115	.004	.009
297-298	168.17	—1.253	—1.252	—1.252	+.001	+.116	.007	.009
298-299	168.26	—3.369	—3.365	—3.367	+.004	+.120	.013	.009
299-300	168.42	—2.199	—2.200	—2.199	—.001	+.119	.003	.009
300-301	168.42	+1.422	+1.422	+1.422	.000	+.119	.000	.009
301-302	168.61	+2.283	+2.286	+2.284	+.003	+.122	.007	.009
302-303	168.67	—1.355	—1.354	—1.354	+.001	+.123	.004	.009
303-304	168.96	+0.310	+0.305	+0.307	—.005	+.118	.009	.009
304-305	169.58	+0.677	+0.667	+0.672	—.010	+.108	.013	.008
305-306	170.25	—2.552	—2.548	—2.550	+.004	+.112	.005	.009
306-307	170.58	+3.011	+3.011	+3.011	.000	+.112	.000	.009
307-308	170.95	—2.645	—2.641	—2.643	+.004	+.116	.007	.009
308-309	171.46	+3.795	+3.786	+3.790	—.009	+.107	.013	.008
309-310	172.26	—0.465	—0.465	—0.465	.000	+.107	.000	.008

TABLE No. 8—(*Continued*).

(1) Bench marks.	(2) Distance from Green-bush.	(3) Difference of Elevation. Line west.	(4) Line east.	(5) Mean.	(6) Partial excess = e.	(7) Total excess = E.	(8) Value of "c" in e = c√miles, Col. 6.	(9) V · of "C" in E = C√miles, Col. 7.
310-311	173.06	—9.533	—9.536	—9.534	—.003	+.104	.008	.008
311-312	173.17	+12.777	+12.774	+12.775	—.003	+.101	.009	.008
312-313	173.35	+5.344	+5.342	+5.343	—.002	+.099	.005	.008
313-314	174.19	—0.038	—0.026	—0.032	+.012	+.111	.013	.008
314-315	174.94	—8.986	—8.986	—8.986	.000	+.111	.000	.008
315-316	175.08	+8.728	+8.725	+8.726	—.003	+.108	.008	.008
316-317	175.98	—4.996	—5.004	—5.000	—.008	+.100	.008	.008
317-318	176.68	—6.407	—6.421	+6.414	—.014	+.086	.016	.006
318-319	177.10	+12.311	+12.314	+12.312	+.003	+.089	.005	.007
319-320	179.21	+0.007	+0.010	+0.008	+.003	+.092	.002	.007
320-321	179.23	—3.988	—3.989	—3.988	—.001	+.091	.007	.007
321-322	181.79	+3.936	+3.922	+3.929	—.014	+.077	.009	.006
322-323	182.56	—10.352	—10.362	—10.357	—.010	+.067	.011	.005
323-324	183.40	+7.483	+7.491	+7.487	+.008	+.075	.009	.006
324-325	184.33	+0.953	+0.955	+0.954	+.002	+.077	.002	.006
325-326	184.35	—3.078	—3.080	—3.079	—.002	+.075	.014	.006
326-327	185.26	+0.250	+0.262	—0.256	+.012	+.087	.013	.006
327-328	186.60	+2.242	+2.244	+2.243	+.002	+.089	.002	.007
328-329	186.87	+0.276	+0.270	+0.273	—.006	+.083	.012	.006
329-330	186.96	—1.153	—1.153	—1.153	.000	+.083	.000	.006
330-331	187.14	+0.005	+0.011	+0.008	+.006	+.089	.014	.006
331-332	188.07	—2.524	—2.513	—2.518	+.011	+.100	.011	.007
332-333	188.40	—3.920	—3.923	—3.921	—.003	+.097	.005	.007
333-334	188.94	+2.245	+2.247	—2.246	+.002	+.099	.003	.007
334-335	189.26	—2.778	—2.786	—2.782	—.008	+.091	.014	.007
335-336	189.46	+1.955	+1.956	+1.955	+.001	+.092	.002	.007
336 337	190.70	—0.245	—0.257	—0.251	—.012	+.080	.011	.006
337-338	191.12	—0.862	—0.860	—0.861	+.002	+.082	.003	.006
338-339	191.19	+0.910	+0.909	+0.909	—.001	+.081	.004	.006
339-340	191.25	—3.579	—3.578	—3.578	+.001	+.082	.004	.006
340-341	191.47	+2.797	+2.795	+2.796	—.002	+.080	.004	.006
341-342	192.02	+0.984	+0.986	+0.985	+.002	+.082	.003	.006
342-343	192.44	—0.123	—0.113	—0.118	+.010	+.092	.015	.007
343-344	192.85	—3.193	—3.189	—3.191	+.004	+.096	.006	.007
344-345	193.68	+4.701	+4.687	+4.694	—.014	+.082	.015	.006
345-346	195.06	—6.786	—6.767	—6.776	+.019	+.101	.016	.007
346-347	195.11	+5.954	+5.954	+5.954	.000	+.101	.000	.007
347-348	195.23	—1.186	—1.189	—1.187	—.003	+.098	.009	.007
348-349	195.45	—3.261	—3.262	—3.261	—.001	+.097	.002	.007
349-350	195.56	+3.301	+3.303	+3.302	+.002	+.099	.006	.007
350-351	195.66	—0.920	—0.921	—0.920	—.001	+.098	.003	.007
351-352	195.87	—3.341	—3.340	—3.340	+.001	+.099	.002	.007
352-353	196.66	—7.481	—7.483	—7.482	—.002	+.097	.002	.007
353-354	198.58	+0.564	+0.543	+0.554	—.021	+.076	.016	.005
354-355	198.70	+1.029	+1.028	+1.028	—.001	+.075	.003	.005
355-356	198.81	—1.013	—1.014	—1.013	—.001	+.074	.003	.005
356-357	199.81	+1.058	+1.055	+1.056	—.003	+.071	.003	.005
357-358	199.89	—0.259	—0.260	—0.259	—.001	+.070	.004	.005
358-359	200.19	—0.251	—0.250	—0.250	+.001	+.071	.002	.005
359-360	200.64	+0.287	+0.296	+0.291	+.009	+.080	.013	.006
360-361	200.79	—0.169	—0.165	—0.167	+.004	+.084	.010	.006
361-362	202.95	—0.141	—0.129	—0.135	+.012	+.096	.008	.007
362-363	202.95	—0.260	—0.260	—0.260	.000	+.096	.000	.007
363-364	203.21	—4.835	—4.834	—4.834	+.001	+.097	.002	.007
364-365	204.22	+2.003	+2.012	+2.007	+.009	+.106	.009	.007
365-366	204.96	+2.280	+2.281	+2.280	+.001	+.107	.001	.007
366-367	205.31	—6.580	—6.576	—6.578	+.004	+.111	.007	.008
367-368	206.39	—0.438	—0.450	—0.444	—.012	+.099	.012	.007
368-369	206.65	+8.044	+8.040	+8.042	—.004	+.095	.008	.007
369-370	207.18	—9.173	—9.170	—9.171	+.003	+.098	.004	.007
370-371	208.10	+1.109	+1.106	+1.107	—.003	+.095	.003	.007
371-372	208.65	+0.908	+0.910	+0.909	+.002	+.097	.003	.007
372-373	208.97	+7.356	+7.373	+7.364	+.017	+.114	.008	.008
373-374	209.27	—1.690	—1.694	—1.692	—.004	+.110	.007	.008
374-375	209.79	—6.112	—6.098	—6.105	+.014	+.124	.019	.009
375-376	211.43	+9.376	+9.382	+9.379	+.006	+.130	.005	.009
376-377	212.67	+0.346	+0.374	+0.360	+.028	+.158	.025	.011
377-378	212.84	+2.060	+2.052	+2.056	—.008	+.150	.019	.010
378-379	213.63	+0.316	+0.309	+0.312	—.007	+.143	.008	.010
379-380	214.29	+0.653	+0.651	+0.652	—.002	+.141	.002	.010
380-381	215.10	—8.257	—8.234	—8.245	+.023	+.164	.026	.011
381-382	215.68	+7.083	+7.076	+7.079	—.007	+.157	.009	.011
382-383	215.83	+5.448	+5.440	+5.444	—.008	+.149	.021	.010
383-384	216.23	+2.401	+2.417	+2.409	+.016	+.165	.025	.011
384-385	216.70	+0.849	+0.874	+0.861	+.025	+.190	.037	.013

TABLE No. 8—(*Continued*).

(1) Bench marks.	(2) Distance from Green-bush.	(3) Difference of Elevation. Line west.	(4) Line east.	(5) Mean.	(6) Partial excess = e.	(7) Total excess = E.	(8) Value of "c" in e = c√miles, Col. 6.	(9) Value of "C" in E = C√miles, Col. 7.
385-386	217.38	—0.745	—0.740	—0.742	+.005	+.195	.006	.013
386-387	217.72	—0.142	—0.123	—0.132	+.019	+.214	.033	.015
387-388	218.06	—0.071	—0.067	—0.069	+.004	+.218	.007	.015
388-389	218.90	+0.806	+0.814	+0.810	+.008	+.226	.009	.015
389-390	218.97	—0.334	—0.340	—0.337	—.006	+.220	.023	.015
390-391	219.05	—1.635	—1.627	—1.631	+.008	+.228	.028	.015
391-392	219.24	+4.719	+4.716	+4.717	—.003	+.225	.007	.015
392-393	219.67	+0.379	+0.371	+0.375	—.008	+.217	.012	.015
393-394	220.47	+3.099	+3.099	+3.099	.000	+.217	.000	.015
394-395	220.85	+0.899	+0.899	+0.899	.000	+.217	.000	.015
395-396	220.92	+5.939	+5.942	+5.940	+.003	+.220	.011	.015
396-397	221.90	+2.416	+2.414	+2.415	—.002	+.218	.002	.015
397-398	222.17	—8.135	—8.133	—8.134	+.002	+.220	.004	.015
398-399	222.82	+7.872	+7.876	+7.874	+.004	+.224	.005	.015
399-400	223.60	—7.024	—7.036	—7.030	—.012	+.212	.014	.014
400-401	224.13	+12.369	+12.365	+12.367	—.004	+.208	.006	.014
401-402	224.29	+8.300	+8.309	+8.304	+.009	+.217	.022	.014
402-403	224.45	+7.899	+7.896	+7.897	—.003	+.214	.008	.014
403-404	224.92	+1.329	+1.324	+1.326	—.005	+.209	.007	.014
404-405	225.28	—2.040	—2.035	—2.037	+.005	+.214	.008	.014
405-406	226.21	+3.695	+3.742	+3.718	+.047	+.261	.049	.017
406-407	226.83	—0.686	—0.683	—0.684	+.003	+.264	.004	.017
407-408	227.53	+0.002	+0.002	+0.002	.000	+.264	.000	.017
408-409	227.95	+0.372	+0.394	+0.383	+.022	+.286	.034	.019
409-410	228.47	—0.104	—0.109	—0.106	—.005	+.281	.007	.019
410-411	231.04	+0.523	+0.519	+0.521	—.004	+.277	.002	.018
411-412	232.88	—0.632	—0.621	—0.627	+.012	+.289	.008	.019
412-413	233.32	+2.260	+2.261	+2.260	+.001	+.290	.002	.019
413-414	233.82	—3.737	—3.765	—3.751	—.028	+.262	.040	.017
414-415	234.50	+1.118	+1.108	+1.113	—.010	+.252	.012	.016
415-416	234.71	—1.954	—1.956	—1.955	—.002	+.250	.004	.016
416-417	235.13	+3.391	+3.385	+3.388	—.006	+.244	.009	.016
417-418	235.49	+0.096	+0.095	+0.095	—.001	+.243	.002	.016
418-419	236.60	+6.217	+6.211	+6.214	—.006	+.237	.006	.015
419-420	237.44	+7.135	+7.139	+7.137	+.004	+.241	.004	.016
420-421	238.61	+2.309	+2.329	+2.319	+.020	+.261	.018	.017
421-422	240.77	+0.622	+0.576	+0.599	—.046	+.215	.031	.014
422-423	243.06	+1.112	+1.096	+1.104	—.016	+.199	.010	.013
423-424	244.10	—5.939	—5.905	—5.922	+.034	+.233	.033	.015
424-425	244.75	+5.959	+5.953	+5.956	—.006	+.227	.007	.014
425-426	245.25	—1.243	—1.254	—1.248	—.011	+.216	.016	.014
426-427	246.34	—0.284	—0.286	—0.285	—.002	+.214	.002	.014
427-428	246.76	—9.948	—9.963	—9.955	—.015	+.199	.023	.013
428-429	247.87	+8.608	+8.591	+8.599	—.017	+.182	.016	.012
429-430	248.22	+1.342	+1.342	+1.342	.000	+.182	.000	.012
430-431	248.99	—1.324	—1.322	—1.323	+.002	+.184	.002	.012
431-432	249.33	+1.137	+1.142	+1.139	+.005	+.189	.009	.012
432-433	250.92	—1.305	—1.322	—1.313	—.017	+.172	.013	.011
433-434	251.57	+1.410	+1.404	+1.407	—.006	+.166	.007	.010
434-435	252.06	+0.572	+0.587	+0.579	+.015	+.181	.021	.011
435-436	252.36	—0.002	—0.008	—0.005	—.006	+.175	.011	.011
436-437	252.82	—0.146	—0.153	—0.149	—.007	+.168	.010	.011
437-438	253.27	—11.783	—11.801	—11.792	—.018	+.150	.026	.009
438-439	253.71	—3.417	—3.416	—3.416	+.001	+.151	.001	.009
439-440	254.33	+15.015	+15.029	+15.022	+.014	+.165	.018	.010
440-441	254.60	+6.234	+6.244	+6.239	+.010	+.175	.020	.011
441-442	255.09	+2.092	+2.082	+2.087	—.010	+.165	.014	.010
442-443	255.58	+1.552	+1.558	+1.555	+.006	+.171	.009	.011
443-444	256.36	—0.080	—0.074	—0.077	+.006	+.177	.007	.011
444.445	257.07	—0.069	—0.069	—0.069	.000	+.177	.000	.011
445-446	257.44	+5.455	+5.441	+5.448	—.014	+.163	.023	.010
446-447	257.99	+9.993	+9.990	+9.991	—.003	+.160	.004	.010
447-448	258.37	+10.132	+10.130	+10.131	—.002	+.158	.003	.010
448-449	258.70	+3.422	+3.419	+3.420	—.003	+.155	.005	.010
449-450	259.43	+5.900	+5.899	+5.899	—.001	+.154	.001	.010
450-451	259.71	+2.908	+2.905	+2.906	—.003	+.151	.006	.009
451-452	260.13	—0.150	—0.144	—0.147	+.006	+.157	.009	.010
452-453	260.75	—3.218	—3.218	—3.218	.000	+.157	.000	.010
453-454	261.62	+2.758	+2.748	+2.753	—0.10	+.147	.011	.009
454-455	262.54	—0.776	—0.758	—0.767	+.018	+.165	.019	.010
455-456	263.37	+2.169	+2.176	+2.172	+.007	+.172	.008	.011
456-457	263.90	—1.767	—1.763	—1.765	+.004	+.176	.006	.011
457-458	264.82	+0.860	+0.849	+0.854	—.011	+.165	.011	.010
458-459	265.35	+0.740	+0.736	+0.738	—.004	+.161	.005	.010
459-460	267.32	—0.257	—0.283	—0.270	—.026	+.135	.019	.008

TABLE No. 8—(*Continued*).

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Bench marks.	Distance from Green-bush.	Difference of Elevation. Line west.	Line east.	Mean.	Partial excess = e.	Total excess = E.	Value of "c" in e = c√miles. Col. 6.	Value of "C" in E = C√miles. Col. 7.
460-461	268.21	—1.382	—1.369	—1.375	+.013	+.148	.014	.009
461-462	268.90	+0.540	+0.557	+0.548	+.017	+.165	.020	.010
462-463	270.28	+1.406	+1.361	+1.383	—.045	+.120	.038	.007
463-464	271.35	—1.231	—1.220	—1.225	+.011	+.131	.011	.008
464-465	272.26	+0.160	+0.185	+0.172	+.025	+.156	.026	.009
465-466	273.01	+0.248	+0.248	+0.248	.000	+.156	.000	.009
466-467	273.01	+1.047	+1.048	+1.048	+.001	+.157	.000	.009
467-468	274.33	—1.351	—1.375	—1.363	—.024	+.133	.021	.008
468-469	275.40	+0.923	+0.927	+0.925	+.004	+.137	.004	.008
469-470	275.78	—0.410	—0.413	—0.411	—.003	+.134	.005	.008
470-471	276.80	+1.530	+1.551	+1.540	+.021	+.155	.020	.009
471-472	277.26	—6.154	—6.151	—6.152	+.003	+.158	.004	.010
472-473	277.86	+3.630	+3.647	+3.638	+.017	+.175	.022	.010
473-474	278.17	+1.615	+1.616	+1.615	+.001	+.176	.002	.011
474-475	280.27	—2.833	—2.843	—2.838	—.010	+.166	.007	.010
475-476	280.74	+1.806	+1.822	+1.814	+.016	+.182	.023	.011
476-477	280.75	—1.541	—1.544	—1.542	—.003	+.179	.030	.011
477-478	281.94	+3.867	+3.861	+3.864	—.006	+.173	.005	.010
478-479	283.32	—4.136	—4.156	—4.146	—.020	+.153	.014	.009
479-480	284.51	+4.829	+4.852	+4.840	+.023	+.176	.021	.010
480-481	284.97	—0.861	—0.846	—0.853	+.015	+.191	.022	.011
481-482	286.48	+0.569	+0.558	+0.563	—.011	+.180	.009	.011
482-483	288.15	—0.228	—0.222	—0.225	+.006	+.186	.005	.011
483-484	289.42	—0.681	—0.674	—0.677	+.007	+.193	.006	.011
484-485	290.16	+1.379	+1.355	+1.367	—.024	+.169	.028	.010
485-486	291.68	+0.281	+0.277	+0.279	—.004	+.165	.003	.010
486-487	293.23	—1.502	—1.481	—1.491	+.021	+.186	.017	.011
487-488	294.49	—1.922	—1.898	—1.910	+.024	+.210	.021	.012
488-489	295.74	+2.948	+2.946	+2.947	—.002	+.208	.002	.012
489-490	296.37	—1.795	—1.781	—1.788	+.014	+.222	.018	.013
490-491	297.92	+1.026	+0.988	+1.007	—.038	+.184	.030	.011
491-492	297.92	+0.007	+0.007	+0.007	.000	+.184	.000	.011
492-493	298.21	+1.146	+1.158	+1.152	+.012	+.196	.021	.011
493-494	299.17	—1.173	—1.173	—1.173	.000	+.196	.000	.011
494-495	300.39	—5.051	—5.082	—5.066	—.031	+.165	.028	.010
495-496	300.97	+6.003	+6.005	+6.004	+.002	+.167	.003	.010
496-497	302.69	—3.037	—2.986	—3.011	+.051	+.218	.038	.013
497-498	303.36	+1.564	+1.540	+1.552	—.024	+.194	.029	.011
498-499	304.12	+1.313	+1.294	+1.303	—.019	+.175	.022	.010
499-500	304.77	—0.601	—0.601	—0.601	.000	+.175	.000	.010
500-501	305 00	—2.133	—2.139	—2.136	—.006	+.169	.012	.010
501-502	305.14	+1.675	+1.675	+1.675	.000	+.169	.000	.010
502-503	305.63	+1.791	+1.788	+1.789	—.003	+.166	.004	.009
503-504	305.85	—2.863	—2.867	—2.865	—.004	+.162	.008	.009
504-505	306.36	—2.769	—2.764	—2.766	+.005	+.167	.007	.010
505-506	307.12	+4.701	+4.705	+4.703	+.004	+.171	.005	.010
506-507	307.79	+1.583	+1.588	+1.585	+.005	+.176	.006	.010
507-508	308.54	—0.057	—0.046	—0.051	+.011	+.187	.013	.011
508-509	309.63	—6.215	—6.217	—6.216	—.002	+.185	.002	.011
509-510	310.25	+4.064	+4.056	+4.060	—.008	+.177	.010	.010
510-511	311.08	—6.829	—6.817	—6.823	+.012	+.189	.013	.011
511-512	311.94	+7.811	+7.804	+7.807	—.007	+.182	.007	.010
512-513	313.49	+0.166	+0.166	+0.166	.000	+.182	.000	.010
513-514	314.06	—0.459	—0.469	—0.464	—.010	+.172	.013	.010
514-515	315.46	—5.870	—5.878	—5.874	—.008	+.164	.007	.009
515-516	315.82	—0.996	—1.007	—1.001	—.011	+.153	.018	.009
516-517	316.72	+6.669	+6.689	+6.679	+.020	+.173	.021	.010
517-518	317.27	—7.461	—7.469	—7.465	—.008	+.165	.011	.009
518-519	317.52	—1.756	—1.756	—1.756	.000	+.165	.000	.009
519-520	318.69	+13.803	+13.825	+13.814	+.022	+.187	.020	.010
520-521	319.55	—0.166	—0.166	—0.166	.000	+.187	.000	.010
521-522	320.47	+0.666	+0.654	+0.660	—.012	+.175	.012	.010
522-523	321.17	—8.255	—8.236	—8.246	+.019	+.194	.023	.011
523-524	321.46	+2.591	+2.591	+2.591	.000	+.194	.000	.011
524-525	321.88	+0.895	+0.890	+0.892	—.005	+.189	.008	.011
525-526	322.13	+2.407	+2.389	+2.398	—.018	+.171	.036	.010
526-527	322.23	+51.727	+51.728	+51.728	+.001	+.172	.010	.010
527-528	323.63	+4.435	+4.415	+4.425	—.020	+.152	.017	.008
528-529	324.96	+2.482	+2.483	+2.482	+.001	+.153	.001	.008
529-530	326.23	—2.669	—2.632	—2.650	+.037	+.190	.032	.010
530-531	327.41	+6.537	+6.547	+6.542	+.010	+.200	.009	.011
531-532	328.94	—6.061	—6.107	—6.084	—.046	+.154	.037	.009
532-533	331.05	+0.710	+0.713	+0.711	+.003	+.157	.002	.009
533-534	331.74	+0.487	+0.487	+0.487	.000	+.157	.000	.009
534-535	333.46	+0.951	+0.971	+0.961	+.020	+.177	.015	.010

TABLE NO. 8—(*Concluded*).

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Distance from	Difference of Elevation.					Value of	Value of
Bench marks.	Green-bush.	Line west.	Line east.	Mean.	Partial excess = e.	Total excess = E.	"c" in e = c√miles. Col. 6.	"C" in E = C√miles. Col. 7.
535-536	334.46	—2.135	—2.130	—2.132	+.005	+.182	.005	.010
536-537	336.66	+0.377	+0.350	+0.363	—.027	+.155	.018	.008
537-538	340.24	+3.348	+3.391	+3.369	+.043	+.198	.023	.011
538-539	340.66	—3.874	—3.863	—3.868	+.011	+.209	.017	.011
539-540	341.07	+3.480	+3.492	+3.486	+.012	+.221	.019	.012
540-541	341.72	—0.168	—0.160	—0.164	+.008	+.229	.010	.012
541-542	343.36	+0.028	+0.048	+0.038	+.020	+.249	.015	.014
542-543	344.39	—2.341	—2.336	—2.338	+.005	+.254	.005	.014
543-544	345.23	+1.059	+1.058	+1.058	—.001	+.253	.001	.014
544-545	346.25	+0.861	+0.860	+0.860	—.001	+.252	.001	.014
545-546	348.07	+1.368	+1.390	+1.379	+.022	+.274	.016	.015
546-547	348.52	—3.023	—3.025	—3.024	—.002	+.272	.003	.015
547-548	348.92	+3.399	+3.401	+3.400	+.002	+.274	.003	.015
548-549	350-12	+1.803	+1.818	+1.810	+.015	+.289	.014	.015
549-550	351.27	—5.387	—5.414	—5.400	—.027	+.262	.025	.014
550-551	351.90	+5.538	+5.534	+5.536	—.004	+.258	.005	.013
551-552	353.08	—2.289	—2.292	—2.290	—.003	+.255	.003	.014
552-553	353.89	+10.577	+10.589	+10.583	+.012	+.267	.013	.014

TABLE NO. 9.

ERIE CANAL.

Comparison of Differences—Results of Levels of 1901, *Survey and Levels of U. S. Deep Waterway.*

(1)	(2)	(3)	(4)	(5)	(6)
Bench Marks.		Elevations above Greenbush.		Differences.	
1901.	U. S. D. W.	1901.	U. S. D. W.	1901.	U. S. D. W.
	a		*a*		
0	0.00	0.000	0.000		
12	7.06	7.310	7.360	+7.310	+7.360
26	10.76	145.901	146.000	+138.591	+138.640
33	12.09	146.740	146.910	+0.839	+0.910
36	14.05	180.674	180.820	+33.934	+33.910
57	27.41	256.540	256.540	+75.866	+75.720
65	30.70	226.365	226.340	—30.175	—30.200
67	31.53	218.978	218.940	—7.387	—7.400
71	33.41	221.051	221.000	+2.073	+2.060
74A	34.77	228.633	228.540	+7.582	+7.540
76A	36.00	236.724	236.640	+8.091	+8.100
89	44.86	249.667	249.630	+12.943	+12.990
95	50.45	265.931	265.860	+16.264	+16.230
97	52.19	268.458	268.460	+2.527	+2.600
101	53.27	284.969	284.950	+16.511	+16.490
106	54.97	288.785	288.790	+3.816	+3.840
112	56.88	284.465	284.490	—4.320	—4.300
115	58.23	285.935	285.970	+1.470	+1.480
118	60.72	285.364	285.400	—0.571	—0.570
121	62.28	285.728	285.820	+0.364	+0.420
124	63.68	283.237	283.320	—2.491	—2.500
125	64.78	283.213	283.310	—0.024	—0.010
127	66.56	284.874	284.950	+1.661	+1.640
131	67.96	289.502	289.610	+4.628	+4.660
136	70.50	292.413	292.530	+2.911	+2.920
140	72.86	293.333	293.450	+0.920	+0.920
142A	74.00	299.949	300.060	+6.616	+6.610
148	77.46	298.930	299.100	—1.019	—0.960
151	78.66	305.297	305.520	+6.367	+6.420
154	80.82	307.762	308.010	+2.465	+2.490
158	81.84	314.069	314.280	+6.307	+6.270
160	82.56	314.664	314.870	+0.595	+0.590
164	84.19	320.825	321.000	+6.161	+6.130
168	86.84	322.736	322.920	+1.911	+1.920
169	88.51	329.388	329.570	+6.652	+6.650
173	89.59	363.407	363.580	+34.019	+34.010
175	90.78	363.703	363.890	+0.296	+0.310
177	91.75	364.170	364.340	+0.467	+0.450
179	92.28	366.985	367.170	+2.815	+2.830
182	94.29	370.620	370.860	+3.635	+3.690
187	96.39	374.481	374.680	+3.861	+3.820
203	101.66	404.621	404.850	+30.140	+30.170
232	117.28	419.975	420.270	+15.354	+15.420
Phoenix	173.34	344.329	344.260	—75.646	—76.010

a Report of the Board of Engineers on Deep Waterways, 1900, pages 1017–1023.

TABLE No. 10.

ERIE CANAL.

Comparison of Differences—Results of Levels of 1901, *Survey and Levels of U. S. Lake Survey.*

(1) Bench Marks. 1901.	(2) Bench Marks. U. S. L. S.	(3) Elevations above Greenbush. 1901.	(4) Elevations above Greenbush. U. S. L. S.	(5) Differences. 1901.	(6) Differences. U. S. L. S.
	a		a		
0	0	0.000	0.000		
4a	2	2.929	2.870	+2.929	+2.870
5b	3	12.337	12.256	+9.408	+9.386
26	8A	145.901	145.804	+133 564	+133.548
58	15	203.389	203.270	+57.488	+57.466
81	19	236.933	236.814	+33.544	+33.544
89	21	249.667	249.583	+12.734	+12.769
95	24A	265.931	265.819	+16.264	+16.236
102	25	288.288	288.256	+22.357	+23.437
129	29	291.291	291.336	+3.003	+3.080
133	30	289.675	289.808	−1.616	−1.528
136	31	292.413	292.499	+2.738	+2.691
151	34	305.297	305.533	+12.884	+13.034
153	34A	305.278	305.492	−0.019	−0.041
157	35	313.502	313.764	+8.224	+8.272
158	35A	314.069	314.303	+0.567	+0.539
165	36	321.919	322.144	+7.850	+7.841
166	36A	321.989	322.200	+0.070	+0.056
169	37	329.388	[redacted]	+7.399	+7.346
177	38A	364.170	364.367	+34.782	+34.821
184	39A	379.183	379.648	+15.013	+15.281
185	39	379.188	379.605	+0.005	−0.043
203	41	404.621	404.889	+25.433	+25.284

a Appendix No. 8, Report of U. S. Coast and Geodetic Survey for 1898-1899, pages 540-541, adjusted line. These figures in the original C. and G. S. table were given in metres, but are here reduced to feet.

TABLE No. 11.

ERIE CANAL.

Comparison of Differences—Results of Levels of 1901, *Survey and Levels of U. S. Lake and Deep Waterway Surveys.*

(1) Bench Marks. 1901	(2) Bench Marks. U. S. L. S.	(3) Bench Marks. U. S. D. W.	(4) Elevations above Greenbush. 1901.	(5) Elevations above Greenbush. U. S. L. S.	(6) Elevations above Greenbush. U. S. D. W.	(7) Differences. 1901	(8) Differences. U. S. L. S.	(9) Differences. U. S. D. W
00	0							
26	8A	19.76	145.901	145.804	146.000	+145.901	+145.804	+146.000
89	21	44.86	249.667	249.583	249.630	+103.766	+103.779	+103.630
95	24A	50 45	265.931	265.819	265.860	+16.264	+16.236	+16.230
136	31	70.50	292.413	292.499	292.530	+26 482	+26.680	+26.670
151	34	78.66	305 297	305 533	305.520	+12.884	+13.034	+12.990
158	35A	81.84	314.069	314.303	314.280	+8.772	+8.770	+8.760
169	37	88.51	329 388	329 546	329.570	+15.319	+15.243	+15.290
203	41	101.86	404.621	404.889	404.850	+75.233	+75.343	+75.280

NOTE.—Columns 1 and 2—Number of bench mark. Column 3—Miles from Greenbush, U. S. D. W. benches. No numbers in U. S. D. W. record. Columns 5 and 8 are deduced from Appendix No. 8 (U. S. Coast and Geodetic Survey), report for 1898–99, adjusted line. Columns 3, 6 and 9 are from the report of the Board of Engineers on Deep Waterways, 1900. pages 1017–1031.

TABLE No. 12.

CHAMPLAIN CANAL.

Comparison of Differences—Results of Levels of 1901, *Survey and Levels of U. S. D. W.*

A column gives list number of bench marks in this report.
B column gives miles from Greenbush B. M.

Bench Marks. A. 1901.	B. U. S. D. W.	Elevations above Greenbush. 1901.	Elevations above Greenbush. U. S. D. W.	Differences. 1901.	Differences. U. S. D. W.
Erie Canal B.M.:					
12	7.06b	7.310	7.360b		
Champlain Canal B. M.:					
6	12.60a	21.779	21.840a	+14.469	+14.480
13	15.90	38.313	38.380	+16.534	+16.540
20	20.00	74.490	74.600	+36.177	+36.220
21	20.10	74.663	74.790	+0.173	+0.190
25	22.10	72.167	72.260	—2.496	—2.530
30	23.60	75.187	75.260	+3.020	+3.000
35	27.10	89.357	89.470	+14.170	+14.210
38	28.10	91.158	91.300	+1.801	+1.830
50	34.10	91.864	92.050	+0.706	+0.750
55	37.20	91.970	92.160	+0.106	+0.110
57	38.30	90.412	90.610	—1.558	—1.550
60	39.00	95.203	95.340	+4.791	+4.730
67	41.80	109.295	109.480	+14.092	+14.140
76	45.00	127.991	128.140	+18.696	+18.660
82	47.10	128.111	128.200	+0.120	+0.060
89	49.80	130.693	130.800	+2.582	+2.600
95	53.20	131.753	131.950	+1.060	+1.150
101	57.70	127.643	127.810	—4.110	—4.140
112	62.00	125.440	125.630	—2.203	—2.180
115	65.10	117.135	117.350	—8.305	—8.280
120	68.10	119.747	119.930	+2.612	+2.580
130	73.20	89.645	89.820	—30.102	—30.110

a Report of Board of Engineers on Deep Waterways. 1900, pages 1023–1025.
b Report of Board of Engineers on Deep Waterways, 1900, page 1018.

LIST

OF

BENCH MARKS

NEW YORK STATE (

EASTERN DIVISIOI

ERIE CANAL,

FROM ALBANY TO THE HERKIMER–ONEII

FROM LEVELS OF 1900 AND

TABLE NO. 18.

List of Bench Marks, Erie Canal, Eastern Division, from Albany to the East Line of Oneida County, N. Y. Greenbush to Herkimer Levels of 1901, *Herkimer to East Line of Oneida County, Differences, Corrected for Rod Error, from Levels of* 1900.

B. M. No.	DESCRIPTION.	Miles from Greenbush.	ELEVATION ABOVE Mean tide, New York, 1900.	ELEVATION ABOVE Greenbush, 1901.	ELEVATION ABOVE Mean tide, New York, 1901.
0	Grist Mill, a cross cut on the (*vertical face*) N. W. side of the N. E. corner of stone foundation of steam grist mill at Greenbush, N. Y.	0.00	....	0.00	14.730
1	Cross + cut in iron bolt N. E. corner N. coping stone W. abutment Island bridge foot of State street, Albany	0.76	....	—1.043	13.687
2	Government building foot of State street, Albany, N. Y. lower basement window sill E. end State street side. Marked ⊕	0.76	....	4.569	19.299
3	State hall, Albany	1.20	....	....	....
4	On shelf at lower end of pier between locks at lock No. 1 marked ⊕ with chisel. (Canal B. M. No. 1.)	1.44	....	—3.770	10.960
4a	Lock No. 1 top of stone at center of cross in top of masonry at S. W. corner of east wall of west lock	1.44	....	2.929	17.659
5	On coping of lock No. 2 between ends of anchor of S. W. gate of W. lock marked ⊕. (Canal B. M. No. 7.)	2.68	....	12.321	27.051
5a	On the N. end towpath parapet of culvert, marked ⊕ with chisel E. of bridge No. 6. (Canal B. M. No. 8.)	3.18	....	11.135	25.865
6	Square ☐ cut in first step, towpath abutment, S. wing, E. end of D. & H. R. R. bridge. New B. M.	3.75	....	16.162	30.892
7	On coping of retaining wall at S end of towpath parapet of Culvert marked ⊕ with chisel. (Canal B. M. No. 12.)	5.03	....	11.863	26.593
8	Bridge No. 12, N. E. corner N. wing of towpath abutment on coping marked ⊕ with chisel. (Canal B. M. No. 14.)	5.53	....	18.296	33.026
9	On coping of lock at "lower side cut" at anchor of N. W. gate marked with chisel. (Canal B M. No. 15.)	6.18	....	12.312	27.042
10	On towpath abutment of old arsenal bridge at N. angle of main wall, top of lower course, marked ⊕ and above B. M. with chisel. (Canal B. M. No. 16)	6.48	....	15.189	29.919
11	Square ☐ cut near N. E. corner of foundation stone S. main tower towpath end lift bridge Congress street, Watervliet	7.18	....	14.528	29.258
12	U. S. D. W. B. M., on second stone second course of masonry, N. E. corner W. abutment Congress street bridge over Hudson River	7.30	....	7.310	22.040
13	On coping of N. wall of N. lock of "upper side cut" N. W. corner of W. stone marked ⊕ with chisel. Canal B. M. No. 18.)	7.38	....	12.977	27.707
14	On coping of lock No. 3 between ends of anchor S. W. gate of W. lock, marked ⊕ with chisel. (Canal B. M. No. 21.)	7.93	....	23.829	38.559
15	On coping of lock No. 4 between ends of anchor S. W. gate of W. lock, marked ⊕ with chisel. (Canal B. M. No. 23.)	8.25	....	34.985	49.715
16	On coping of lock No. 5 between ends of anchor S. W. gate of W. lock, marked ⊕ with chisel. (Canal B. M. No. 25.)	8.52	....	45.763	60.493
17	On coping of lock No. 6 between ends of anchor S. W. gate of W. lock, marked ⊕ with chisel. (Canal B. M. No. 27.)	8.73	....	55.767	70.497
18	On coping of lock No. 7 between ends of anchor S. E. gate of E. lock, marked ☐ with chisel. (Canal B. M. No. 29.)	8.86	....	65.418	80.148
19	On coping of lock No. 8 between ends of anchor S. W. gate of W. lock, marked ⊕ with chisel. (Canal B. M. No. 31.)	9.02	....	75.668	90.398

TABLE NO. 13—(*Continued*).

B. M. No.	DESCRIPTION.	Miles from Greenbush.	Elevation Above: Mean tide, New York, 1900.	Elevation Above: Greenbush, 1901.	Elevation Above: Mean tide, New York, 1901.
20	On coping of lock No. 9 between ends of anchor S. E. gate of E. lock, marked ⊕ with chisel. (Canal B. M. No. 33.)	9.36	....	85.796	100.526
21	Square ▢ cut on coping of lock No. 10 between ends of anchor S. W. gate of W. lock. (Canal B. M. No. 35.)	9.53	....	95.740	110.470
22	On coping of lock No. 11 between ends of anchor S. W. gate of W. lock, marked ⊕ with chisel. (Canal B. M. No. 37.)	9.69	....	105.750	120.480
23	On coping of lock No. 12 between ends of anchor S. W. gate of W. lock, marked ⊕ with chisel. (Canal B. M. No. 39.)	9.84	....	115.839	130.569
24	On coping of lock No. 13 between ends of anchor S. E. gate of E. lock, marked ⊕ with chisel. (Canal B. M. No. 41.)	10.04	....	125.736	140.466
25	On coping of lock No. 14 between ends of anchor S. E. gate of E. lock, marked ⊕ with chisel. (Canal B. M. No. 43.)	10.26	....	135.674	150.404
26	Arrow ↕ cut on coping S. W. corner of E. wall, W. lock, lock No 15 U. S. D. W. B. M., U. S. L. S. B. M. No. 8a	10.53	....	145.901	160.631
27	On coping of lock No. 15 between ends of anchor S. E. gate of E. lock, marked ⊕ with chisel. (Canal B. M. No. 45.)	10.53	....	145.801	160.531
28	On coping of lock No. 16 between ends of anchor S. E. gate of E. lock, marked ⊕ with chisel. (Canal B. M. No. 47.)	10.72	....	155.742	170.472
29	Bolt head in coping of lock No. 17 between ends of anchor S. W. gate of W. lock, marked + with chisel	11.04	....	165.881	180.611
30	On coping of lock No. 18 between ends of anchor S. W. gate of W. lock, marked ⊕ with chisel. (Canal B. M. No. 51.)	11.23	....	176.163	190.893
31	Square ▢ cut on coping E. end S. side wall of waste-weir No. 5, just N. of bridge No. 30. (Canal B. M. destroyed.)	11.60	....	176.409	191.139
32	Point cut in square ▢ on N. E. corner lower step N. end of berme abutment bridge No. 31, new B. M.	11.97	....	178.150	192 880
33	U. S. D. W. B. M., arrow ↕ cut on the S. W. corner of the top stone on the S. end of breakwater above the Cohoes Water Company's gatehouse and near the western end of this Company's dam	12.07	....	146.740	161.470
34	Destroyed	....	....	....	....
35	On top of coping of S. wing at end of towpath abutment, bridge No. 33 marked ⊕ B. M. with chisel. (Canal B. M. No. 57.)	13.34	....	178.372	193.102
36	On top of coping S. W. corner S. E. wing of aqueduct at Crescent, marked ⊕ with chisel. (Canal B. M. No. 59.)	13.98	....	180 674	195.404
37	On top of coping N. W. corner S. E. wing of aqueduct at Crescent, marked ⊕ with chisel. (Canal B. M. No. 60.)	14.20	....	180.581	195.311
38	Bridge No. 36 at center of towpath abutment on face, sixth course under coping, marked ⊕ B. M. with chisel. (Canal B. M. No. 62.)	15.47	....	177.503	192.233
39	Bridge No. 37 at center of towpath abutment on face, sixth course under coping, marked ⊕ B. M. with chisel	15.87	....	179 066	193.796
40	Destroyed	....	....	....	....
41	Bridge No. 38, on projection sixth course below coping near centre towpath abutment, marked ⊕ B. M. with chisel. (Canal B. M. No. 64.)	16.62	....	177.253	191.983
42	Bridge No. 39, on projection sixth course below coping near W. angle face of towpath abutment, marked ⊕ B. M. with chisel. (Canal B. M. No. 65.)	17.62	....	178.351	193.08[illegible]

TABLE NO. 13—(*Continued*).

B. M. No.	DESCRIPTION.	Miles from Greenbush.	Elevation Above: Mean tide, New York, 1900.	Elevation Above: Greenbush, 1901.	Elevation Above: Mean tide, New York, 1901.
43	Bridge No. 41, on face towpath abutment six course below coping near E. angle, marked ⊕ B. M. (Canal B. M. No. 68.)....	18.00	....	178.262	192.992
44	Bridge No. 42, on face towpath abutment fifth course below coping near W. angle, marked ⊕ B. M. (Canal B. M. No. 69.)...	18.31	....	178.289	193.019
45	Bridge No. 43, on face towpath abutment sixth course below coping near centre, marked ⊕ B. M. (Canal B. M. No. 70.)...	18.69	....	176.801	191.531
46	Bridge No. 46, second bridge E. of lock No. 19, on projection of towpath abutment fifth course below coping near E. angle, marked ⊕ B. M. (U. S. L. S. 12.) (Canal B. M. No. 72.)..	19.44	....	176.952	191.682
47	Bridge No 47, first bridge E. of lock No. 19, on top of first stone under coping E. corner E wing on towpath abutment, marked ⊕ B. M. (Canal B. M. No. 73)............	19.86	....	179.097	193.827
48	On coping of lock No. 19, near end of anchor N. E. gate S. lock pier wall, marked ⊕ B. M. (Canal B. M. No. 75.)..	20.09	....	184.582	199.312
49	Bridge No. 48, Vischer's Ferry, square ▢ cut on third course of masonry E. wing towpath abutment, new B. M.	20.96	....	189.349	204.079
50	Point ⊡ cut in square between ends of anchor N. lock, S. E. gate of lock No. 20, new B. M.........................	23.83	....	194.478	209.208
51	Bridge No. 49, at Fonda's Basin, on top of coping E. end of wing berme abutment, marked ⊕ with chisel. (Canal B. M. No. 81)	24.18	....	198.749	213.479
52	Square ▢ cut on the N. E. corner of coping of lock No. 21, about 10 feet from end of anchor of S. E. gate S. lock. (Old B. M. destroyed.)	26.05	....	207.568	222.298
53	Square ▢ cut on coping of lock No. 22 between ends of anchor N. E. gate of N. lock. (Old B. M. destroyed.)	26.23	....	217.473	232.203
54	On N. E. corner of coping on end of towpath wing at N. end of upper Mohawk Aqueduct at Rexford Flats marked, ⊕ B. M. (Canal B M. No. 86.).....................	26.31	....	218.377	233.107
55	On top dowel in coping of parapet near end of parapet at Rexford Flats towpath wing S. end of Upper Mohawk Aqueduct, marked ⊕ B. M. (Canal B. M. No. 87.)........ .	26.43	....	222.054	236.784
56	Bridge No. 51, on top of coping N. wing berme abutment, first bridge W. of aqueduct. marked ⊕ B. M. (Canal B. M. No. 88.)...	26.53	....	221.867	236.597
57	U. S. D. W. B. M., a square ▢ cut in W. corner of step at ladies' entrance to the R. R. station of the Troy and Schenectady branch at aqueduct.........................	26.60	....	256.540	271.270
58	U. S. L. S. B. M. No. 15 on coping 1.5 feet from S. corner of W. abutment of Rexford feeder bridge, 4 miles south of Schenectady.	26.06	....	203.389	218.119
59	Bridge No. 52, on projection of lower course on face towpath abutment near W. angle marked ⊕ B. M. (Canal B M. No. 89.)...	28.00	....	217.347	232.077
60	Bridge No. 53, on face of towpath abutment near centre, on projection of sixth course under coping, marked ⊕ B. M. (Canal B. M. No. 90.)	28.23	....	219.217	233.947
61	On second step W. end towpath abutment of D. & H. R. R. bridge E. of Schenectady marked ▢ B M. New B. M...............	28.85	....	220.935	235.665
62	Bridge No. 54, on top of coping. W. wing wall, berme abutment, marked ⊕ B. M. (Canal B. M. No. 92.)	29.10	....	219.061	233.791
63	Bridge No. 55, on top of coping on end of E. wing of towpath abutment, marked ⊕ B. M. (Canal B. M. No. 93.)...................	29.52	....	220.563	235.293

TABLE NO. 12—(*Continued*).

B. M. No.	DESCRIPTION.	Miles from Greenbush.	Elevation Above: Mean tide, New York, 1900.	Greenbush, 1901.	Mean tide, New York, 1901.
64	Square □ cut on S. W. corner of coping W. end of towpath abutment on swing bridge near Schenectady Locomotive Works. New B. M.	29.77	....	221.153	235.883
65	U. S. D. W. B. M., a square □ cut on the S. W. end of the top of the S. W. coping stone of culvert No. 47 of the Troy and Schenectady branch opposite the Schenectady Locomotive Works and about 400 feet E. of Romeyn street crossing	30.11	....	226.365	241.095
66	Bridge No. 56, square □ cut on first step W. wing wall towpath abutment at Green street, Schenectady, new B. M.	30.07	....	218.971	233.701
66a	Bridge No. 57, Jefferson street, Schenectady, on S. W. corner of coping of retaining wall E. of towpath abutment, marked ⊕ B. M. (Canal B. M. No. 95.)	30.10	....	222.496	237.226
66b	Bridge No. 59, Liberty street, on coping of retaining wall W. end of bridge approach towpath abutment, new B. M. marked □ with chisel	30.18	....	221.107	235.837
67	U. S. D. W. B. M., a square □ cut on the S. E. corner of foundation stone of the N. W. column of the Church street lift bridge over the Erie canal at Schenectady	30.57	....	218.978	233.708
68	On top of coping W. end of parapet S. W. corner of waste weir opposite Westinghouse works, marked ⊕ B. M. (Canal B. M. No 97.)	30.77	....	220.297	235 027
69	Square □ cut on N. E. corner of coping on culvert No. 28, towpath at W. end of General Electric works, new B. M.	31.33	....	209.255	223.985
70	Bridge No. 63, Navonier's bay, on projection of sixth course below coping, near center of towpath abutment, on face marked ⊕ B. M. (Canal B. M. No. 98.)	32.47	....	217.970	232.700
71	U. S. D. W. B. M., square □ cut on N. W. corner of top of N. stone in third course of the E. abutment of bridge No. 63 over the Erie canal, about 1¾ miles W. of Rotterdam street bridge at Schenectady	32.47	....	221.051	235.781
72	On top of copying of lock No. 23, between ends of anchor N. E. gate of N. lock, marked ⊕ B. M. (Canal B. M. No. 99.)	33.15	....	225.590	240.320
73	Bridge No. 64, on face tow path abutment near W. angle on projection of sixth course below copying, marked ⊕ B. M. (Canal B. M. No. 101.)	33.26	....	226.250	240.980
74a	U. S. D. W. B. M., Square □ cut on E. corner of N. E. end of shelf at lower end of lock No. 24. Marked □ B. M.	33.94	....	228.633	243.363
74	On coping of lock No. 24, between ends of anchor N. E. gate of N. lock, marked ⊕ B. M. (Canal B. M. No. 103.)	33.94	....	234.013	248.743
75	Bridge No. 65, on projection of sixth course on face near centre of tow-path abutment, marked ⊕ B. M. (Canal B. M. No. 104.)	34.56	....	236.586	251.316
76a	U. S. D. W. B. M., Square □ cut on the N. corner of the bottom stone step of brick house (Van Slyck homestead), at bridge No. 66, E. of Flat Stone Creek aqueduct	35.18	....	236.724	251.454
76	Bridge No. 66, on projection of sixth course below coping on face near E. angle towpath abutment, marked ⊕ B. M. (Canal B. M. No. 105.)	35.18	....	235.155	249.885
77	Flat Stone Creek aqueduct, square □ cut E. end of parapet N. E. corner towpath side, new B. M.	35.85	....	237.993	252.723
78	Bridge No. 67, on projection of sixth course below coping near center on face of towpath abutment, marked ⊕ B. M. (Canal B. M. No. 107.)	36.20	....	236.559	251.289

TABLE NO. 13—(*Continued*).

B. M. No.	DESCRIPTION.	Miles from Greenbush.	ELEVATION ABOVE		
			Mean tide, New York, 1900.	Greenbush, 1901.	Mean tide, New York, 1901.
79	Bridge No. 68, on projection of seventh course below coping on face near W. angle towpath abutment, marked ⊕ B. M. (Canal B. M. No. 108.)	36.66	....	235.396	250.126
80	Bridge No. 69, on projection of seventh course below coping near center on face of towpath abutment, marked ⊕ B. M. This is also U. S. L. S. B. M. No. 19. (Canal B. M. No. 109.)	37.61	....	234.124	248.854
81	Bridge No. 69, U. S. L. S. B. M. No. 15a, top of projection of third course S. E. wing towpath abutment, marked ⊕ B. M.	37.61	....	236.933	251.663
82	On coping of lock No. 25 between ends of anchor N. E. gate of N. lock, marked ⊕ B. M. (Canal B. M. 111.)	37.74	....	241.861	256.591
83	Bridge No. 71, on corner of coping on end of W. wing towpath abutment, marked ⊕ B. M. (Canal B. M. No. 112.)	38.24	....	244.264	258.994
84	Bridge No. 72, on projection of fourth course below coping on face of towpath abutment near W. angle, marked ⊕ B. M. (Canal B. M. No. 113.)	38.66	....	245.143	259.873
85a	On projection of seventh course fourth stone from S. E. angle of pier R. R. bridge over Erie Canal and Mohawk River about three-quarters of a mile E. of Pattersonville, marked ⊕ B. M. New B. M.	39.21	....	243.453	258.183
85	Bridge No. 73 on coping end of W. wing berme abutment, marked ⊕ B. M. (Canal B. M. No. 114.)	39.21	....	244.493	259.223
86	On the coping of parapet Sansai Kill aqueduct at E. angle (junction of wing with straight wall) marked ⊕ B. M. (Canal B. M. No. 115.)	39.87	....	245.385	260.115
87	On flat sandstone on back angle of towpath at W. end of second tangent E. of bridge No. 76, marked ⊕ B. M. (Canal B. M. No. 118.)	42.07	....	240.863	255.593
88	Bridge No. 76 on first stone under coping E. wing towpath abutment, (marked ⊕ B. M.)	43.48	....	244.496	259.226
89	U. S. L. S. B. M. No. 21 and U. S. D. W. B. M. ○ on E. corner of coping of S. wall of N. lock. (Lock No. 26.)	44.12	....	249.667	264.397
90	On coping of lock No. 26, between ends of anchor N. E. gate N. lock, marked ⊕ B. M. (Canal B. M. No. 123)	44.12	....	249.729	264.459
91	Square □ cut on coping of lock No. 27, between ends of anchor N. E. gate of N. lock, new B. M.	44.82	....	257.672	272.403
92	Square □ cut on N. W. corner of wasteweir top of E. wall one-half mile E. of Amsterdam river bridge. New B. M.	46.37	....	258.018	272.748
93	Bridge No. 78, on top of lower step at W. end towpath abutment, marked ⊕ B. M. (Canal B. M. No. 129.)	46.86	....	265.421	280.151
94	On top of coping on centre pier of Chuctanunda creek culvert, towpath side, marked ⊕ B. M. (Canal B. M. No. 130.)	47.13	....	249.649	264.379
95	U. S. L. S. B. M. No. 24a and U. S. D. W. B. M. top of iron bolt in top coping about one-half way between the two locks on E. wall of lock No. 28, marked ⊕ B. M.	49.54	....	265.931	280.661
96	Bridge No. 80, on projection sixth course below coping on face in centre of towpath abutment, marked ⊕ B. M. (Canal B. M. No. 134.)	51.26	....	268.449	283.179
97	Bridge No. 80, U. S. D. W. B. M., on same bridge as B. M. No. 96, square □ cut on coping of W. wing towpath abutment, first bridge E. of lock No. 29.	51.26	....	268.458	283.188

TABLE NO. 13—(*Continued*).

B. M. No.	DESCRIPTION.	Miles from Green-bush.	Elevation Above: Mean tide, New York, 1900.	Elevation Above: Green-bush, 1901.	Elevation Above: Mean tide, New York, 1901.
98	On coping of lock No. 29 between ends of anchor N. E. gate of N. lock, marked ⊕ B. M. (Canal B. M. No. 136.)	51.51	....	273.255	287.985
99	Bridge No. 81, on projection of fourth course below coping on face of towpath abutment near E. angle, marked ⊕ B. M. (Canal B. M. No. 137.)	51.88	....	276.458	291.188
100	On coping of lock No. 30 between ends of anchor N. E. gate of N. lock, marked ⊕ B. M. Condition poor. (Canal B. M. No. 139.)	52.14	....	283.901	298.631
100a	On N. wall S. lock No. 30, first stone E. of junction of old wall and extension, new B. M., marked □ B. M., 1901	52.14	....	283.896	298.626
101	At foot of parapet on end of W. wing of Schoharie Creek aqueduct, towpath side, marked □ B. M. This is also U. S. D. W. B. M. (Canal B. M. No. 140.)	52.37	....	284.969	299.699
102	Bridge No. 83, U. S. L. S. B. M. No. 25. Cross cut on face of corner stone, fifth course N. E. corner of towpath abutment, marked ⊕ B. M.	52.80	....	288.288	303.018
104	Bridge No. 84, on top of lower step W. wing berme abutment, marked ⊕ B. M. (Canal B. M. No. 142.)	53.68	....	288.134	302.864
105	Bridge No. 85, on face towpath abutment near E. angle on projection fifth course below coping, marked ⊕ B. M. (Canal B. M. No. 143.)	54.04	....	286.548	301.278
106	U. S. D. W. B. M. Square □ cut on the W. end of the W. wing wall of N. abutment of bridge over Erie Canal about 2,000 feet west of W. S. R. R. station at Auriesville, Bridge No. 85	54.04	....	288.785	303.515
107	Bridge No. 86, on face of towpath abutment near W. angle on projection sixth course below coping, marked ⊕ B. M. (Canal B. M. No. 144.)	54.40	....	286.096	300.826
109	Bridge No. 88, on face of towpath abutment near E. angle on projection fourth course below coping marked ⊕ B. M. (Canal B. M. No. 145.)	55.30	....	286.092	300.822
110	Bridge No. 89, on face of towpath abutment near W. angle on projection of fourth course below coping marked ⊕ B. M. (Canal B. M. No. 146.)	55.64	....	286.897	301.627
111	Bridge No. 90, on top of lower step W. wing berme abutment, marked ⊕ B. M. (Canal B. M. No. 147.)	55.96	....	287.868	302.598
112	U. S. D. W. B. M., same bridge point on face of stone about three feet from corner of the first course W. wing towpath abutment	55.96	....	284.465	299.195
113	Bridge No. 91, on top of lower step E. berme abutment, marked ⊕ B. M. (Canal B. M. No. 148.)	56.45	....	286.592	301.322
114	Bridge No. 93, on second step of E. wing berme abutment Main street, Fultonville. New B. M., marked ⊕ B. M.	57.31	....	288.032	302.762
115	Bridge No. 94, U. S. D. W. B. M., point cut on top of projection fourth stone of second course on the W. end of towpath abutment, marked ⊡ B. M.	57.43	....	285.935	300.665
116	Bridge No. 95, on top of coping at end of E. wing towpath abutment, marked ⊕ B. M. (Canal B. M. No. 150.)	58.17	....	287.496	302.226
117	Bridge No. 96, on face towpath abutment near E. angle on projection of fourth course below coping, marked ⊕ B. M. (Canal B. M. No. 151.)	58.87	....	285.925	300.655
118	Bridge No. 91, U. S. D. W. B. M. on projection of stone W. wing second stone from angle towpath abutment, marked □ B. M.	59.79	....	285.364	300.094

TABLE NO. 12—(*Continued*).

B. M. No.	DESCRIPTION.	Miles from Greenbush.	ELEVATION ABOVE Mean tide, New York, 1900.	Greenbush, 1901.	Mean tide, New York, 1901.
119	Bridge No. 97, on face of top stone end of W. wing towpath abutment, marked ⊕ B. M. (Canal B. M. No. 152.)	59.79	....	286.889	301.619
120	On top of coping at end of E. wing of Tokkon Creek aqueduct, towpath side, marked ⊕ B. M. (Canal B. M. No. 153.)	60.44	....	283.017	297.747
121	Bridge No 98, U. S. D. W. B. M. on face of towpath abutment near E. angle on projection of fourth stone below coping, marked ⊕ B. M. (Canal B. M. No. 154.)	61.34	....	285.728	300.458
122	Bridge No. 99, on top of second stone below coping at end of E. wing berme abutment, marked ⊕ B. M. (Canal B. M. No. 155.)	62.30	....	285.558	300.288
123	On top of coping N. E. corner N. E. wing of Leonardson's Creek aqueduct, towpath side, marked ⊕ B. M. (Canal B. M. No. 156.)	62.71	....	283.190	297.920
124	U. S. D. W. B. M., on top of coping S. E. corner W. wing Leonardson's Creek aqueduct, towpath side, marked ☐ B. M.	62.71	....	283.237	297.967
125	U. S. D. W. B. M., square ☐ cut on coping N. E corner N. W. wing of N. wall, second aqueduct W. of Downing's station, W. S. R. R.	63.83	....	283.213	297.943
126	On face of towpath abutment of private road bridge E. of lock No. 31 on projection of second course from bottom near center. New B. M. marked ⊕ B. M.	64.72	....	285.571	300.301
127	Bridge No. 102, U. S D. W. B. M., projection on face of second stone from E. end of E. wing of towpath abutment, about three feet above ground, marked ⊕ B. M.	65.62	....	284.874	299.604
128	On coping of lock No. 31, between ends of anchor N. E. gate S. lock. New B. M., marked ⊕ B. M.	66.00	....	289.787	304.517
129	Bridge No 104, U. S. L. S. B. M. No. 29, top of iron bolt in coping W. wing towpath abutment Ferry street bridge, Spraker's	66.22	....	291.291	306.021
130	Bridge No. 105, on face towpath abutment near W. angle on projection, fifth course below coping, marked ⊕ B. M. (Canal B. M. No. 162.)	66.62	....	292.128	306.858
131	Bridge No. 106, U. S. D. W. B. M., on projection of bottom course first stone from E. end of E. wing, towpath side, marked ⊕ B. M	67.04	....	289.502	304.232
132	Bridge No. 106, on face of towpath abutment near centre on projection, sixth course below coping, marked ⊕ B. M. (Canal B M. No. 163.)	67.04	....	290.653	305.383
133	Bridge No. 107, N. Y. S. and U. S. L. S. B. M. N. 30, on face of towpath abutment near W. angle on projection, seventh course below coping marked ⊕. (Canal B. M. No. 164.)	67.79	....	289.675	304.405
134	Bridge No. 108, on face of towpath abutment near centre, on projection of fourth course below coping, marked ⊕ B. M. (Canal B. M. No. 165)	68.59	....	290.590	305.320
135	On coping of parapet at N. E. wing of Canajoharie Creek aqueduct, towpath side, marked ⊕ B. M. (Canal B. M. No. 166.)	69.17	....	294.098	308.828
136	U. S D. W. B. M. and U. S. L. S. B. M. No. 31, cross ⊕ cut in first stone of second course E. corner of wall under old barn on towpath near foot bridge W. of Canajoharie	69.55	....	292.418	307.148
137	Bridge No. 111, on coping at end of W. wing towpath abutment, marked ⊕ B. M. (Canal B. M. No. 167.)	69.98	....	293.341	308.071

TABLE NO. 13—(*Continued*).

B. M. No.	DESCRIPTION.	Miles from Green-bush.	Elevation Above: Mean tide, New York, 1900.	Elevation Above: Green-bush, 1901.	Elevation Above: Mean tide, New York, 1901.
138	Bridge No. 112, on rear upper corner of stone under coping at W. wing, berme abutment. marked ⊕ B. M. (Canal B. M. No. 168.)..	70.63	....	292.139	306.869
139	Bridge No. 113, on face near center of E. wing, towpath abutment, on projection second stone above ground, marked ⊕ B. M. (Canal B. M. No. 169.)...............	71.94	....	291.518	306.248
140	Bridge No. 113, U. S. D. W. B. M., square □ cut under coping on rear side of E. wing towpath abutment..............	71.94	....	293.333	308.063
141	On coping of lock No. 32 between ends of anchor N. E. gate of N. lock, marked ⊕ B. M. (Canal B. M. No. 171.)............	72.32	....	298.072	312.802
142a	Bridge No. 117, U S D. W. B. M., square □ cut on coping E. wing towpath abutment first bridge E. of Fort Plain..............	73.07	....	299.949	314.679
142	Bridge No. 117, on top of coping at end of W. wing towpath abutment, marked ⊕ B. M. (Canal B. M. No. 173.)..........	73.07	....	300.155	314.885
143	Bridge No. 118, on face of towpath abutment on projection sixth course below coping (near center), marked ⊕ B. M. (Canal B. M. No 174.)	73.47	....	298.381	313.111
144	W. S. R. R. bridge No. 278, on face of tow-path abutment near center on projection second course from ground. New B. M., marked ⊕ B. M......................	73.77	....	299.659	314.389
145	On coping of culvert No. 63 near center tow-path, marked ⊕ B. M. (Canal B. M. No. 175.)	73.87	....	293.513	308.243
146	On top of coping W. wing of culvert No. 65 towpath side, marked □ B. M. New B. M.	74.58	....	296.455	311.185
147	On corner of coping E. wing wall (towpath side) of culvert No. 67 marked ⊕ B. M. (Canal B. M. No. 176.)......................	76.28	....	295.605	310.335
148	Bridge No. 119, U. S. D. W. B. M., on top of coping E. wing towpath abutment, marked □ B. M......................	76.58	....	298.930	313.660
149	Bridge No. 119, on face of towpath abutment near W. angle on projection sixth course below coping, marked ⊕ B. M. (Canal B. M. No. 177.)............	76.58	....	299.207	313.937
150	On coping of lock No. 33 between ends of anchor N. E. gate of N. lock, marked ⊕ B. M. (Canal B. M. No. 179.)....	77.43	....	303.538	318.268
151	Bridge No. 120, U. S. D. W. B. M., and U. S. L. S. B. M. No. 34 on face of second course of masonry of E. wing wall near center towpath abutment, marked ⊕ B. M........	77.71	....	305.297	320.027
152	Bridge No. 120, U. S. L. S. B. M. No. 34a, on face of second course of masonry W. wing wall towpath abutment, marked B. M. with chisel	77.71	....	305.278	320.008
153	Bridge No. 121, on top of second step E. wing towpath abutment of bridge at St. Johns-ville. New B. M., marked □ B. M.........	78.25	....	306.623	321.353
154	Bridge No. 122, U. S. D. W. B. M., on top of lower step E. wing of towpath abutment, marked □ B. M	79.72	....	307.762	322.492
155	On coping of lock No. 34 between ends of anchor N. E. gate of N. lock, marked ⊡ B. M. New B. M......................	80.00	....	311.554	326.284
156	Bridge No. 124, on face of towpath abutment near W. angle on projection of seventh course below coping, marked ⊕ B. M. (Canal B. M. No. 185.)......................	80 57	....	311.651	326.381
157	Bridge No. 125, U. S. L. S. B. M. No. 35 on projection second course E. wing towpath abutment, marked ⊕ B. M	80.89	....	313.502	328.232

TABLE NO. 13—(*Continued*).

B. M. No.	DESCRIPTION.	Miles from Green-bush.	Elevation Above: Mean tide, New York, 1900.	Green-bush, 1901.	Mean tide, New York, 1901.
158	Same bridge, U. S. L. S. B. M. No. 35 A and U. S. D. W. B. M. on projection of second course W. wing towpath abutment, marked ⊕ B. M.	80.89	....	314.069	328.799
159	Bridge No. 126, on projection of seventh course below coping near center towpath abutment, marked ⊕ B. M. (Canal B. M. No. 186.)	81.19	....	313.717	328.447
160	Bridge No. 127, U. S. D. W. B. M. on top of stone third course E. wing rear of towpath abutment, marked □ B. M.	81.59	....	314.664	329.394
161	Bridge No. 128, on face of towpath abutment near W. angle on projection of seventh course below coping, marked ⊕ B. M. (Canal B. M. No. 187.)	82.19	....	312.729	327.459
162	Bridge No. 129, on face of towpath abutment near center on projection seventh course below coping marked ⊕ B. M. (Canal B. M. No. 188.)	82.72	....	312.494	327.224
163	On coping of lock No. 35 between end's of anchor N. E. gate of N. lock marked ⊕ B. M. (Canal B. M. No. 190.)	83.18	....	319.708	334.438
164	U. S. D. W. B. M. on cap stone of E. wing of aqueduct No. 12, Indian Castle aqueduct, towpath side, marked □ B. M.	83.28	....	320.825	335.555
165	Bridge No. 131 at center of W. wing on face of towpath abutment third course from ground marked ○ (U. S. L. S. B. M. No. 36)	83.61	....	321.919	336.649
166	Bridge No. 131 on face towpath abutment on projection third course from ground (near center) marked ○ "U. S. L. S. B. M. No. 36A"	83.61	....	321.989	336.719
167	Bridge No. 132 on top of coping E. wing berme abutment of farm bridge marked ⊕ with chisel (Canal B. M. No. 192.)	84.06	....	324.460	339.190
168	Bridge No. 133. U. S. D. W. B. M. on top of cap stone E. wing towpath abutment of farm bridge about 600 feet N. of the Herkimer monument marked □ with chisel	85.87	....	322.736	337.466
169	Lock No. 36 U. S. D. W. B. M. and U. S. L. S. No. 37. Top of iron bolt between ends of anchor N. E. gate N. Lock, marked ⊕ with chisel	87.55	....	329.388	344.118
170	On coping of lock No. 37 at ends of anchor N. E. gate N. lock, marked ⊕ with chisel	88.17	....	339.429	354.159
171	On coping of lock No. 38 between ends of anchor N. E. gate N. lock, marked □ with chisel. (Canal B. M. No. 200.)	88.33	....	349.059	363.789
172	On coping lock No. 39 at ends of anchor N. E. gate N. lock, marked ⊕ with chisel. (Canal B. M. No. 202.)	88.55	....	359.105	373.835
173	U. S. D. W. B. M. on top of coping of west wing towpath abutment Bellinger street bridge, Little Falls, N. Y., marked □ with chisel	88.65	....	363.407	378.137
174	On top of lower step E. wing towpath abutment third bridge W. of lock No. 39, marked □ with chisel. (Private bridge.)	89.21	....	363.105	377.835
175	U. S. D. W. B. M. bridge No 137 on top of coping of E. wing towpath abutment of farm bridge, marked ⊕ with chisel. (Canal B. M. No. 204.)	89.76	....	363.708	378.438
176	Bridge No. 138, on top of coping W. wing berme abutment of farm bridge, marked ⊕ with chisel, (Canal B. M. No. 205.)	90.78	....	364.279	379.009
177	Bridge No. 138, on top of lower step W. wing towpath abutment, first bridge E. of lock No. 40 U. S. L S. B. M. No. 38A. and U. S. D. W. B. M., marked with chisel	90.78	....	364.170	378.900

TABLE NO. 13—(*Continued*).

B. M. No.	DESCRIPTION.	Miles from Green-bush.	ELEVATION ABOVE Mean tide, New York, 1900.	ELEVATION ABOVE Green-bush, 1901.	ELEVATION ABOVE Mean tide, New York, 1901.
178	On coping of lock No. 40 at ends of anchor, N. E. gate N. lock, marked ⊕ with chisel. (Canal B. M. No. 207.)	91.81	....	366.879	381.609
179	U. S. D. W. B. M., + cross cut on head of iron bolt, N. E. gate N. lock No. 40	91.81	....	366.985	381.715
180	Bridge No. 139, on top of lower step E. wing towpath abutment, second bridge west of lock No. 40, marked □ with chisel	92.22	....	371.176	385.906
181	Bridge No. 140, on top of coping W. wing towpath abutment of farm bridge, marked ⊕ with chisel (Canal B. M. No. 209.)	92.87	....	370.886	385.616
182	U. S. D. W. B. M. on top of coping at the end of E. wing towpath abutment, second bridge E. of lock No. 41, marked □ with chisel.	93.29	....	370.620	385.350
183	On coping of lock No. 41, ends of anchor N. E. gate N. lock, marked ⊕ with chisel. (Canal B. M. No. 212.)	93.95	....	375.065	389.795
184	Bridge No. 143, on coping E. wing towpath abutment, farm bridge, U. S. L. S. B. M. No. 39A, marked with chisel	94.83	....	379.183	393.913
185	Bridge No. 143, on coping W. wing towpath abutment farm bridge U. S. L. S. B. M. No. 39, marked with chisel	94.83	....	379.188	393.918
186	Bridge No. 144, barge canal B. M. No. 1 on N. E. corner lower step, E. wing towpath abutment, marked ○ with chisel. (Herkimer road bridge.)	95.31	....	380.388	395.118
187	U. S. D. W. B. M., on top of masonry N. E. corner N. abutment of Mohawk river bridge, Washington street, over Mohawk river, Herkimer, N. Y., marked ⊕ U. S. D. W. B. M	95.42	....	374.481	389.211
188	Cut in small shelf on third stone from W. end lower course, towpath abutment, of street railway bridge between Herkimer and Mohawk	96.43	393.156	378.227	392.957
189	Cross cut in circle on shelf of fourteenth stone from W. end of second course, towpath abutment of W. S. R. R. bridge over the canal at Mohawk, N. Y.	96.55	393.975	379.046	393.776
190	Cross cut in circle on N. W corner, lower step, W. wing, berme abutment, Mohawk canal bridge	96.96	393.675	378.746	393.476
191	Lock No. 42, square cut on coping between ends of anchor, N. E. gate, towpath lock	97.03	....	384.264	398.994
192	Lock No 43, square cut on coping between ends of anchor, N. E gate, towpath lock	97.29	....	392.285	407.015
193	Cross cut in circle on N. E. corner of towpath parapet wall coping of Fulmer Creek aqueduct, at Mohawk	97.33	408.800	393.871	408.601
194	Circle cut in square on S. W. corner, lower step, W. wing, towpath abutment, Meyer's farm bridge, at Mohawk, N. Y.	97.63	411.095	396.166	410.896
195	Circle cut in square on S. W. corner, W. wing, towpath abutment, Typewriters' bridge, Ilion, N. Y.	98.39	410.111	395.182	409.912
196	Circle cut in square on S. E. corner of top foundation stone of N. E. stair landing near post of Railroad street lift bridge, Ilion, N. Y.	98.63	409.423	394.494	409.224
197	Cross cut in circle on W. corner of coping of Steel Creek aqueduct, towpath side, Ilion, N. Y.	98.91	409.350	394.421	409.151
198	Circle cut in square on S. W. corner, lower step of W. wing of towpath abutment of London bridge, Ilion, N. Y.	99.17	411.125	396.196	410.926
199	Cross cut in circle on N. E. corner, second step of east wing, towpath abutment of street railway bridge between Ilion and Frankfort	99.60	410 030	395.101	409.831

TABLE NO. 13—(*Concluded*).

B. M. No.	DESCRIPTION.	Miles from Greenbush.	ELEVATION ABOVE Mean tide, New York, 1900.	Greenbush, 1901.	Mean tide, New York, 1901.
200	Lock No. 44, square cut on coping between ends of anchor, N. E. gate, towpath lock.	100.00	....	403.343	418.073
201	Circle cut in square on S. W. corner, lower step, W. wing, towpath abutment of bridge 650 feet W. of lock 44, Erie canal..........	100.18	421.157	406.228	420.958
202	Circle cut in square on S. W. corner, lower step, W. wing, towpath abutment, Reese's road bridge, Frankfort, N. Y..............	100.56	423.314	408.385	423.115
203	Projection on top of stone in bottom course of stones on S. E. corner towpath abutment of first bridge east of lock 45, Frankfort.	101.18	419.550	404.621	419.351
204	Cross cut in circle on coping, two feet E. of E. hollow quoin, towpath side of Lock 45, Frankfort	101.24	428.159	413.230	427.960
205	Circle cut in square on S. E. corner of lower step, east wing, towpath abutment of Beehive bridge, about three-quarters of a mile west of Frankfort..................	101.68	431.294	416.365	431.095
206	Cross cut in circle on S. E corner, second step, east wing, towpath abutment, bridge No. 161, next west of Beehive bridge......	102.15	431.648	416.719	431.449
207	Circle cut in projection on face of fifth stone from west end in second course in towpath abutment, Frankfort, Centre bridge.......	102.43	430.278	415.349	430.079
208	Circle cut on S. W. corner, lower step, west wing, towpath abutment, Bargy's farm bridge, five miles E. of Herkimer-Oneida county line.......................	102.97	431.997	417.068	431.798
209	Circle cut in S. W. corner, lower step, west wing, towpath abutment, Farm bridge No. 164, 4.4 miles E. of Herkimer-Oneida county line........................	103.56	431.805	416.876	431.606
210	Cross cut in circle on face of stone near W. angle of towpath abutment of Farm bridge No. 165, four miles E. of Herkimer-Oneida county line.......................	103.94	430.904	415.975	430.705
211	Circle cut on first stone W. of E. angle, second course, towpath abutment, Farm bridge No. 163, three miles E. of Herkimer-Oneida county line	104.33	430.396	415.467	430.197
212	Cross cut in circle on projection of first stone in second course, W. angle of towpath abutment, Farm bridge No. 167, 3.7 miles E. of Herkimer-Oneida county line.................................	105.23	429.365	414.436	429.166
213	Cross cut in circle on projection on face of first stone W. of E. angle in second course, towpath abutment, Farm bridge No. 168, 2.2 miles E. of Herkimer-Oneida county line.................................	105.77	431.875	416.946	431.676
214	Circle cut in square on projection on face of second stone from E. angle in second course, towpath abutment, Harbor bridge No. 169..................................	106.06	430.603	415.674	430.404
215	Cross cut in circle on S. E. corner of coping stone on the extreme E. end of parapet wall of Ferguson Creek aqueduct.........	106.88	428.508	413.579	428.309
216	Cross cut in circle on S. E. corner, lower step, E. wing, towpath abutment of first bridge east of Herkimer-Oneida county line.................................	107.41	430.995	416.066	430.796
217	Copper plug in S. E. corner, lower step, east wing, towpath abutment, Green's road bridge at the Herkimer-Oneida county line..................................	107.98	432.198	417.269	431.999

LIST

OF

BENCH MARKS

NEW YORK STATE CANALS

CHAMPLAIN CANAL,

FROM LOCK No. 3, ERIE CANAL, TO WHITEHALL, N. Y.

FROM LEVELS OF 1896 AND 1901.

[illegible]

TABLE NO. 14.

List of Bench Marks, Champlain Canal, from Lock No, 3, Erie Canal, to Whitehall. Levels of 1901.

B. M. No.	DESCRIPTION.	Miles from Lock No. 3 of Erie Canal, 6¼m. N. of Albany.	ELEVATION ABOVE Greenbush.	ELEVATION ABOVE Mean tide, New York.
0	On coping of lock No. 3 Erie canal between ends of anchor S. W, gate of W. lock, corresponds with Canal Survey B. M. No. 14, marked ⊕...........	0.00	23.829	38.559
1	On coping of lock No. 1, between ends of anchor S. E. gate, marked ⊕ with chisel. (Canal B. M. No. 1)........................	1.45	24.357	39.087
2	On coping of lock No. 2, between ends of anchor S. E. gate, marked ⊕ with chisel. (Canal B. M. No. 3)........................	1.56	35.707	50.437
3	On coping of lock No. 3, between ends of anchor S. W. gate, marked ⊕ with chisel. (Canal B. M. No 5)........................	2.36	37.604	52.334
4	On coping of lock No. 4, between ends of anchor N. E. gate, marked □ with chisel................	2.79	41.625	56.355
5	On coping of Waterford side-cut, S. W. angle, upper combined lock, marked ⊕ with chisel. (Canal B. M. No. 9)........................	3.39	35.334	50.064
6	At Waterford, U. S. D. W. B. M., D. & H. R. R. (lower depot) on door sill to W. entrance, marked □ with chisel........................	4.39	21.779	36.509
7	D. & H. R. R. bridge over canal one-quarter mile N. of Waterford, on lower step N. wing towpath abutment, marked □ with chisel............	4.69	40.635	55.365
8	On coping of lock No. 5, between ends of anchor S. E. gate, marked □ with chisel................	5.04	48.360	63.090
9	On coping of lock No. 6, between ends of anchor S E. gate, marked □ with chisel................	5.34	61.571	76.301
10	Bridge No 11, on third step N. wing towpath abutment, marked □ with chisel................	5.62	67.188	81.918
11	Bridge No. 13, on second step S. wing towpath abutment, marked □ with chisel (third bridge N. of lock No. 6)........................	6.42	66.428	81.158
12	Bridge No. 15, on first step S. wing towpath abutment, marked □ with chisel........................	7.16	66.436	81.166
13	U. S. D. W. B. M., square cut on W. windowsill on S. side of Geo. S. Forses' road house, about three and one-half miles N. of Waterford and about one-fourth mile E. of canal........................	7.36	38.313	53.043
14	Bridge No. 16, on first step N. wing towpath abutment of farm bridge, marked □ with chisel.......	7.94	65.519	80.249
15	On coping of lock No. 7, between ends of anchor S. E. gate, marked □ with chisel................	8.26	69.162	83.892
16	Bridge No. 19, on first step N. wing towpath abutment, about 400 feet W. of schoolhouse, marked □ with chisel........................	9.06	74.182	88.912
17	On coping of lock No. 8, between ends of anchor S. E. gate, marked □ with chisel................	9.72	80.246	94.976
18	Bridge No. 21, S. W. corner S. wing lower step towpath abutment, marked □ with chisel............	11.16	81.398	96.128
19	Bridge No. 22, on first step S. wing towpath abutment, marked □ with chisel........................	11.72	82.075	96.805
20	U. S. D. W. B. M., Presbyterian church at Mechanicville, on S. end of stone windowsill between tower and entrance on E. side, square cut........................	12.27	74.490	89.220
21	U. S. D. W. B M., N. E. corner of water table of main building of M. E. church on Main street, Mechanicville........................	12.28	74.663	89.393
22	Bridge No 24, square cut on S. W. corner of S. foundation to lift bridge, Park avenue, Mechanicville, towpath side........................	12.27	81.193	95.923
23	Pulp mill side track bridge, S. W. corner of S. foundation, towpath side, marked □ with chisel..	12.38	81.342	96.072
24	Waste-weir No. 5, on N. E. corner of coping stone of S. abutment, first waste-weir N. of Mechanicville, marked □ with chisel........................	13.31	80.450	95.180
25	U. S. D. W. B. M., head of bolt at base of first S. column just E. of Electric R. R. track W. end of Fitchburg R. R. bridge over Hudson river.......	13.82	72.167	86.897

TABLE NO. 14—(*Continued*).

B. M. No.	DESCRIPTION.	Miles from Lock No. 3 of Erie Canal, 6½m. N. of Albany.	ELEVATION ABOVE Greenbush.	ELEVATION ABOVE Mean tide, New York.
26	On coping, lock No. 9, between ends of anchor S. W. gate, marked □ with chisel	13.84	89.305	104.035
27	Bridge No. 30, on second step S. wing berme abutment, marked □ with chisel	14.36	89.619	104.349
28	Bridge No. 32, on lower step S. wing, berme abutment, marked □ with chisel	14.58	91.677	106.407
29	Bridge No. 33, on lower step S. wing, towpath abutment, Sisson street, Stillwater, marked □ with chisel	14.72	89.760	104.490
30	Stillwater, U. S. D. W. B. M., square cut on large flat stone step of entrance to First M. E. church (S. end of stone)	14.82	75.187	89.917
31	Bridge No. 35, second step S. wing towpath abutment, marked □ with chisel	15.55	90 699	105.429
32	Bridge No. 36, on second step S wing towpath abutment of farm and highway bridge, marked □ with chisel	16.81	90.886	105.616
33	Bridge No. 38, on projection S. wing about 3 feet above ground, towpath abutment, Ford's farm bridge, marked □ with chisel	17.45	92.135	106.865
34	Bridge No. 39, on lower step S. wing towpath abutment, Britton's farm bridge, marked □ with chisel	17.66	91.260	105.990
35	Bemis Heights, U. S. D W. B. M., S. E. corner of N. abutment of waste-weir, iron bolt and stone chiseled away around bolt	17.86	89.357	104.087
36	S. E. corner of middle abutment of Bemis Heights waste-weir, marked + with chisel	17.86	89.605	104.?45
37	Bridge No. 41, point cut on face of masonry second course above ground at E. angle, towpath abutment	18.26	90.198	104.928
38	U. S. D. W. B. M., bridge No. 43, square cut on lower step S. wing towpath abutment, about 1 mile N. of Bemis Heights	18.83	91.158	105.888
39	Bridge No. 44, on lower step S. wing towpath abutment of Van Wie's farm bridge, marked □ with chisel	19.43	91.548	106.278
40	Wilber's waste-weir, square cut on N. E. corner of stone, first step from top of middle abutment	20.01	88.451	103.181
41	Bridge No. 48, on lower step N. wing towpath abutment of farm bridge, marked ○ with chisel	20.51	90.907	105.637
42	Bridge No. 49, circle cut on lower step N. wing towpath abutment (bridge down)	20.91	91.365	106.095
43	Bridge No. 50, on lower step S. wing towpath abutment of road bridge, marked ○ with chisel	21.71	90.649	105.379
44	Bridge No. 51, on lower step N. wing towpath abutment of farm bridge, marked ○ with chisel	21.91	91.323	106.053
45	Bridge No. 52, on second step S. wing berme abutment, first bridge S. of Salisbury's road bridge, marked □ with chisel	22.36	90.826	105.556
46	Bridge No. 53, on first step N. wing towpath abutment of Salisbury's road bridge, marked □ with chisel	22.61	91.286	106.016
47	Bridge No. 54, on second step N. wing towpath abutment of farm bridge, marked □ with chisel.	23.21	91.034	105.764
48	Bridge No 55, on second step N. wing towpath abutment, first bridge S of Electric R. R. bridge near Coveville, marked ○ with chisel	23.97	89.895	104.625
49	Waste-weir at Coveville, on coping of N. abutment, marked ○ with chisel	24.58	88.738	103.468
50	U. S. D. W. B. M., bridge No. 57, on lower step N. wing towpath abutment, 1,000 feet N. of Coveville P. O., marked □ with chisel	24.96	91.864	106.594
51	Bridge No. 58, on lower step N. wing towpath abutment, marked ○ with chisel	25.11	92.075	106.805
52	Bridge No. 59, on lower step S. wing towpath abument, marked ○ with chisel	25.91	92.975	107.705
53	Bridge No. 60, on lower step, S wing towpath abutment, marked □ with chisel (Dwyer farm bridge)	26.21	92.474	107.204
54	Bridge No. 62, on lower step N. wing towpath abutment, first bridge S of Ferry street, Schuylerville, marked □ with chisel	27.81	92.340	107.070

TABLE NO. 14—(*Continued*).

B. M. No.	DESCRIPTION.	Miles from Lock No. 3 of Erie Canal, 6½m. N. of Albany.	ELEVATION ABOVE Greenbush.	Mean tide, New York.
55	Bridge No 63, Schuylerville, U. S. D. W. B. M., on second step N. wing towpath abutment of Ferry street bridge, marked ○ with chisel	27.91	91.970	106.700
56	Bridge No 64, Saratoga street, Schuylerville, on lower step N. wing towpath abutment, first bridge N. of Ferry street, marked □ with chisel	28.11	91.388	106.118
57	U. S. D. W. B. M., bridge No. 65, on second step S. wing berme abutment, road and trolley R. R. bridge, marked □ with chisel	29.01	90.412	105.142
58	On lower step S. wing towpath abutment marked □ with chisel. (Bridge down.)	29.51	93.459	108.189
59	On coping of lock No. 10 between ends of anchor S. E. gate, marked ⊕ with chisel. (Canal B. M. No. 46.)	29.90	95.146	109.876
60	U. S. D. W. B. M., square cut on S. E. corner of coping of E. wall, lock No. 10, marked □ with chisel	29.90	95.203	109.933
61	On coping of lock No. 11, between ends of anchor. S. E. gate, marked □ with chisel	30.53	98.446	113.176
62	Bridge No. 69, on lower step S. wing berme abutment, first bridge N. of lock No. 11, marked ⊕ with chisel. (Canal B. M. No. 49.)	31.01	100.259	114.989
63	Waste weir No. 12, on top step S. abutment, towpath side, marked □ with chisel	31.60	97.583	112.313
64	On coping of lock No. 12, between ends of anchor, S. E. gate, marked □ with chisel	31.96	107.277	122.007
65	Waste weir No. 13, on top of coping, S. wing, marked □ with chisel	32.21	106.351	121.081
66	Bridge No. 74, on lower step N. wing of E. abutment of Fort Miller change bridge, marked □ with chisel	32.45	108.028	122.758
67	Ft. Miller, U. S. D. W. B M., square cut on S. end of S. window sill of brick blacksmith shop facing Hudson river and on E. side of highway	32.50	109.295	124.025
68	Bridge No. 75, on lower step, N. wing, towpath abutment, first bridge S. of lock No. 13, marked ⊕ with chisel	32.94	109.148	123.878
69	On coping of lock No. 13, between ends of anchor, S. W. gate, marked ○ with chisel. (Canal B. M. No. 56.)	33.19	117.855	132.585
70	Bridge No. 77, on lower step, N. wing, towpath abutment of farm bridge, marked □ with chisel	33.44	118.596	133.326
71	Bridge No. 78, on second step, N. wing, towpath abutment of farm bridge, marked ⊕ with chisel.	34.05	118.028	132.758
72	Bridge No. 79, on lower step, N. wing, berme abutment of Comer's farm bridge, marked ⊕ with chisel	34.38	118.598	133.328
73	Bridge No. 80, on lower step, S. wing, berme abutment of farm bridge, marked ⊕ with chisel	34.72	118.914	133.644
74	Bridge No. 81, on lower step, S. wing, towpath abutment, marked ○ with chisel	35.06	118.214	132.944
75	On coping of lock No. 14, between ends of anchor, S. E. gate, marked ⊕ with chisel. (Canal B. M. No. 63.)	35.88	126.516	141.246
76	U. S. D. W. B. M., bridge No. 83, on rear of second course of masonry, N. wing, towpath abutment, marked □ with chisel	36.06	127.991	142.721
77	Bridge No. 84, on lower step, S. wing, towpath abutment, marked ○ with chisel	36.33	126.057	140.787
78	Bridge No. 85, on second step, N. wing, towpath abutment, marked □ with chisel	36.92	126.379	141.109
79	Waste weir No. 14, on N. W. corner of coping of S. abutment, marked □ with chisel	37.24	124.538	139.268
80	Bridge No. 87, on lower step S. wing berme abutment, first bridge N. of Satterlees foot bridge, marked □ with chisel	37.43	127.938	142.668
81	Bridge No. 88, on lower step N. wing towpath abutment of road bridge, marked ⊕ with chisel.	37.98	127.558	142.288
82	U. S. D. W. B. M., bridge No. 90, on second step N. wing towpath abutment of road bridge, marked □ with chisel	38.25	128.111	142.814

TABLE No. 14—(*Continued*).

B. M. No.	DESCRIPTION.	Miles from Lock No. 3 of Erie Canal, 6¼m. N. of Albany.	ELEVATION ABOVE	
			Greenbush.	Mean tide, New York.
83	Bridge No. 91, on lower step S. wing berme abutment of farm bridge, marked ⊕, about 600 feet N. of brick house in field	38.71	127.055	141.785
84	Bridge No. 93, on lower step S. wing, berme abutment of farm bridge, marked ⊕ with chisel	39.17	126.311	141.041
85	Bridge No. 94, on lower step N. wing berme abutment of farm bridge, marked ⊕ with chisel	39.40	127.319	142.049
86	Bridge No. 95, on lower step N. wing berme abutment of road bridge, first bridge S. of electric R. R. near Ft. Edward, marked ⊕ with chisel	40.37	127.925	142.655
87	Bridge No. 96, on second step N. wing towpath abutment, marked ⊕ with chisel	40.65	127.651	142.381
88	On S. end of coping of wall at edge of canal, towpath side of aqueduct No. 4, Ft. Edward, marked ⊕ with chisel	40.75	126.057	140.787
89	Ft. Edward U. S. D. W. B M., and U. S. Geol. Survey aluminum bronze tablet set in N. side of W. entrance of High school building	41.15	130.693	145.423
90	On coping of lock No. 15, between ends of anchor S. E. gate, marked ⊕ with chisel. (Canal B. M. No. 79.)	41.40	134.642	149.372
91	Bridge No. 99, on lower step S. wing berme abutment, first bridge N. of lock No. 15, marked ⊕ with chisel	41.66	135.872	150.602
92	Waste-weir No. 15, on coping of E. wing N. abutment, about 1½ miles N. of Ft. Edward, marked □ with chisel	42.53	134.405	149.135
93	Bridge No. 100, on lower step N. wing berme abutment of change bridge at Glens Falls feeder, marked ⊕ with chisel	43.41	138.937	153.667
94	Bridge No. 101, on second step N. wing berme abutment of farm bridge, marked ○ with chisel	43.85	136.497	151.227
95	U. S. D. W. B. M., N. W. corner of W. stone, top course of masonry of S. abutment of D. & H. R. R. bridge over canal overflow 600 feet S of highway at Durham's Basin, marked □ with chisel	44.53	131.753	146.483
96	Bridge No 102, on lower step N. wing berme abutment of Dunham's road bridge, marked □ with chisel	44.55	134.950	149.680
97	N. W. corner of red barn, on towpath, on stone foundation, marked □ with chisel	45.80	133.845	148.575
98	Spike in W. side of elm tree about 30 feet from front angle of towpath in Davison's front yard, about 3 miles north of Dunham's Basin	47.15	136.808	151.538
99	Bridge No. 103, on projection N. end of second course of masonry, towpath abutment, marked □ with chisel	47.70	136.673	151.403
100	Bridge No. 104, on lower step N. wing towpath abutment, marked □ with chisel	47.90	137.545	152.275
101	Smith's Basin U. S. D W. W. B M., on N. W. corner of W. stone, top course, S. abutment of small plate girder bridge on D. & H. R. R., near station, marked □ with chisel	49.12	127.643	142.373
102	Bridge No. 105, Smith's Basin, on second step N. wing towpath abutment, marked □ with chisel	49.12	135.989	150.719
103	Bridge No. 106, on lower step S. wing berme abutment, marked ⊕ with chisel	49.60	135.891	150.621
104	Bridge No. 107, on lower step N. wing berme abutment, marked □ with chisel	50.10	135.996	150.726
105	Bridge No 108, on lower step S. wing berme abutment, marked □ with chisel	50.35	135.889	150.619
106	Bridge No. 110, on lower step N. wing berme abutment of road bridge, 1¼ miles S. of Fort Ann, marked □ with chisel	51.00	137.404	152.134
107	Bridge No. 111, on lower step N. wing towpath abutment of road bridge, marked □ with chisel	51.47	135.184	149.914
108	Bridge No. 112, on lower step N wing. towpath abutment of farm bridge, marked □ with chisel	51.95	137.972	152.702
109	Bridge No. 113, on lower step, S. wing berme abutment of farm bridge, marked □ with chisel	52.50	137.228	151.958

TABLE NO. 14—(*Concluded*).

B. M. No.	DESCRIPTION.	Miles from Lock No. 3 of Erie Canal, 6⅓m. N. of Albany.	ELEVATION ABOVE Greenbush.	Mean tide, New York.
110	On coping of lock No. 16, between ends of anchor, S. W. gate, marked ☐ with chisel	53.19	134 415	149.145
111	On coping of lock No. 18, between ends of anchor, N. E. gate, marked ☐ with chisel	53.30	118.223	132.953
112	Ft. Ann U. S. D. W. B. M., cross cut on coping of parapet wall to N. abutment of D & H. R. R. bridge over canal. Cross is near N. edge of stone and directly opposite space between the two bridges (cross in hollow)	53.33	125.440	140.170
113	Dewey's private bridge on projection of 5th stone in 2d course of masonry of S. wing, towpath abutment, marked with chisel	55.85	114.369	129.099
114	On coping of lock No. 19, between ends of anchor of N. W. gate, marked ☐ with chisel.............	56.54	112.693	127.423
115	Comstock's U. S. D. W. B. M., square cut on S. E corner of S. coping stone of culvert and on E. side of roadbed of D. & H. R. R., about 2,800 feet S. of station	56.87	117.135	131.865
116	Comstock's road bridge No. 118, on projection of 1st course of masonry, S. wing, towpath abutment, marked ☐ with chisel	57.42	111.190	125.920
117	Private road bridge, on projection of 5th course of masonry below coping, towpath abutment (near center) marked ○ with chisel	58.32	110.778	125.508
118	Bridge No. 120, on 2d step S. wing, towpath abutment, marked ☐ with chisel.......................	59.16	112.111	126.841
119	On coping of lock No. 20, between ends of anchor of N W. gate, marked ☐ with chisel.......	59.51	112.884	127.614
120	Between Comstock's and Whitehall U. S. D. W. B. M., square cut on S. E. corner of stone S. berme abutment of D. & H. R. R bridge over canal on W. side at N. end of plate girder where it connects with middle truss of bridge	59.97	119.747	134.477
121	Bridge No. 125, on lower step, N. wing, berme abutment of farm bridge, about 1 mile N. of lock No. 20, marked ☐ with chisel.	60.59	109.316	124,046
122	Bridge No, 126, lower step N. wing. towpath abutment (iron bridge), marked ☐ with chisel	61.11	110.119	124.849
123	Bridge No. 127, lower step, N. wing, towpath abutment, marked ☐ with chisel..............	61.78	120.020	134.750
124	Bridge No. 129, on lower step N. wing. towpath abutment of farm bridge, marked ☐ with chisel..	62.46	109.199	123.929
125	Bridge No. 130, on second step S. wing, berme abutment of farm bridge, marked ⊕ with chisel.......	62.87	109.962	124.692
126	Bridge No. 131, on lower step N. wing, berme abutment, first bridge S. of D. & H. R. R. bridge, marked ☐ with chisel..............	63.72	111.655	126.385
127	Waste-weir No. 24, on coping of N. wall, E stone, about 1100 feet S. of D. & H. R. R., Rutland branch, marked ☐ with chisel............	64.24	108.775	123.505
128	Bridge No. 132, on lower step. N wing, towpath abutment, Fordman street, Whitehall, marked ☐ with chisel........................	64.65	110.975	125.705
129	On coping of lock No. 21, between ends of anchor, N. E. gate, marked ☐ with chisel................	65.06	107.586	122.316
130	U. S. D. W. B. M., on coping of lock No. 23, between ends of anchor, N. W. gate, marked ⊕ U. S., with chisel..................................	65.18	89.645	104.375

LIST

OF

BENCH MARKS

NEW YORK STATE CANALS

CHAMPLAIN CANAL,

ON GLENS FALLS FEEDER

SUPPLYING SUMMIT-LEVEL FROM FORT EDWARD

TO FORT ANN, N. Y.

FROM LEVELS OF 1897.

These elevations were obtained from a line of levels run by Theodore A. Hendrickson in 1897, and from data on file in the office of the division engineer. They are referred to the datum of the levels of the Barge Canal Survey of 1901, viz., the bench mark on the old grist mill at Greenbush, N. Y., elevation 14.73 feet above mean tide water at New York as established and adopted by the United States Coast and Geodetic Survey in 1877.

List of Bench Marks on the Glens Falls Feeder.

No.	DESCRIPTION.	Distance from Champlain canal, feet.	ELEVATION ABOVE	
			Greenbush B. M., feet.	Mean tide at New York, feet.
1	Road and change bridge No. 100, on the Champlain Canal, at the foot of the Glens Falls Feeder, on lower step, N. wing, berme abutment, marked ⊕ with chisel	....	138.937	153.667
2	On coping of lock No. 1, E. end of lock, N. E. quoin, between gate anchors	250	143.116	157.846
3	On coping of lock No. 2, E. end of lock, N. E. quoin, between gate anchors	703	153.272	168.002
4	On coping of lock No. 3, E. end of lock, N. E. quoin, between gate anchors	805	163.467	178.197
5	On coping of lock No. 4, E. end of lock, N. E. quoin, between gate anchors	1,346	173.562	188.292
6	On coping of lock No. 5, E. end of lock, N. E. quoin, between gate anchors	1,361	183.826	198.556
7	On coping of lock No. 6, E. end of lock, N. E. quoin, between gate anchors	2,597	194.021	208.751
8	On coping of lock No. 7, E end of lock, N. E. quoin, between gate anchors	2,703	204.126	218.856
9	On coping of lock No. 8, E. end of lock, N. E. quoin, between gate anchors	2,809	214.321	229.051
10	On coping of lock No. 9, E. end of lock, N. E. quoin, between gate anchors	2,915	224.285	239.015
11	On coping of lock No. 10, E. end of lock, N. E. quoin, between gate anchors	3,020	234.174	248.904
12	On bridge No. 1, W. of lock No. 10, berme abutment, N. W. corner, W. end, third step, fourth course above water	3,386	238.933	253.663
13	On coping of lock No. 11, towing path side, lower hollow quoin, between gate anchors	3,544	246.121	260.851
14	On coping of lock No. 12, towing path side, lower hollow quoin, between gate anchors	4,762	255.096	269.826
15	On coping of lock No. 13, towing path side, lower hollow quoin, between gate anchors	5,554	265.505	280.235
16	On bridge No. 3, Maple street, Sandy Hill, towing path abutment, E. end, first step	6,303	270.390	285.120
17	On bridge No. 4, Basin street, Sandy Hill, berme abutment, W. end, N. W. corner, first step	....	269.593	284.323
18	On bridge No. 6, Ferry street, Sandy Hill, towing path abutment, W. end, N. W. corner first step	....	270.263	284.993
19	On bridge No. 7, Browns, near Cold spring, towing path abutment, W. end, second step	13,629	268.160	282.890
20	On bridge No. 9, Montys, towing path abutment, W. end, third step	17,924	270.389	285.119

List of Bench Marks on the Glens Falls Feeder—(Concluded).

Number.	DESCRIPTION.	Distance from Champlain canal, feet.	Elevation Above	
			Greenbush B. M., feet.	Mean tide at New York, feet.
21	On bridge No. 10, below cement works, berme abutment, E. end step, level with vertical wall	19,506	271.003	285.733
22	On bridge No. 11, D. & H. C. Co. railroad bridge, berme abutment, E. end second step, N. W. corner	19,982	269.637	284.367
23	On bridge No. 12, Sherman's lime kiln, towing path abutment, second step, W. end	22,202	269.880	284.610
24	On top of stone foundation of trestle, W. end, in rear of Finch & Pruyn's office, Glen street, Glens Falls	about 26,664	269.943	284.673
25	On bridge No. 15, Morgans (first W. of Glen street bridge) on projecting stone at W. end of towing path abutment	28,849	273.550	288.280
26	On change bridge No. 16, north towing path abutment, first step, east end	34,056	270.257	284.987
27	On coping of lock No. 14, guard lock, east end, marked ⊕ with chisel	36,749	270.966	285.696

LIST

OF

BENCH MARKS

NEW YORK STATE CANALS

MIDDLE DIVISION

ERIE CANAL,

FROM THE HERKIMER-ONEIDA COUNTY LINE TO THE SENECA-WAYNE COUNTY LINE.

FROM LEVELS OF 1900 AND 1901.

TABLE No. 15.

List of Bench Marks, Erie Canal, Middle Division, from the Herkimer-Oneida County Line to the Seneca-Wayne County Line. From the Herkimer-Oneida County Line to Grove Spring, from Levels of 1900; Grove Spring to Seneca-Wayne County Line, from Levels of 1901.

B. M. No.	DESCRIPTION.	Miles from Greenbush.	ELEVATION ABOVE Mean tide, New York, 1900.	Greenbush, 1901.	Mean tide, New York, 1901.
217	Copper plug in S. E. corner, lower step, E. wing, towpath abutment, Green's road bridge at the Herkimer-Oneida county line	107.98	432.198	417.269	431.999
218	Tack in elm stub, 40 feet from front angle of towpath, about 200 feet E. of Mohawk Valley Cotton Mills, Utica	108.88	426.939	412.010	426.740
219	Copper plug in S. W. corner of W. end, towpath abutment of Broad street lift bridge, Utica, N. Y	109.98	432.330	417.401	432.131
220	At Utica post-office, bronze tablet W. of E. basement door rear of building, marked "U. S. geological survey B. M. Elev. 419 feet."	110.38	....	403.082	417.812
221	Copper plug in S. W. corner of stone forming foundation of western stairway of Broadway foot bridge, Utica, N. Y	110.68	428.558	413.629	428.359
222	Copper plug in S. W. corner, W. end, towpath abutment, Whitesboro street lift bridge, Utica, N. Y	110.98	432 456	417.527	432.257
223	Lock No. 46, copper plug between ends of anchor, N. E gate, towpath lock	111.35	....	416.329	431.059
224	Copper plug in bottom step, E. wing, towpath abutment, Platt street, Utica, N. Y	111.68	434.981	420.052	434.782
225	Copper plug in lower step, E. wing, towpath abutment, Whitesboro road bridge at W. line of city of Utica	112.58	436.581	421.652	436.382
226	Copper plug, lower step, E. wing towpath abutment, Yorkville road bridge.	113.28	436.491	421.562	436.292
227	Copper plug in second stone from N. E. end of towpath parapet wall of Saquoit Creek aqueduct	113.58	434.420	419.491	434.221
228	Copper plug, S. E. corner, bottom step, E. wing, towpath abutment, Clinton street bridge, Whitesboro	114.18	434.605	419.677	434.407
229	Copper plug, bottom step, E. wing, towpath abutment, Westmoreland street bridge, Whitesboro	114.58	435.899	420.970	435.700
220	Copper plug, S. W. corner, bottom step, E. wing, towpath abutment, Bradley's road bridge between Oriskany and Whitesboro	115.58	437.518	422.589	437.319
231	Copper plug, S. E. corner, bottom step, E. wing, towpath abutment, Evans' farm bridge just E. of Oriskany	116.78	437.092	422.163	436.893
232	Copper plug in S. W. corner of stone on W. end of coping of Oriskany aqueduct, towpath side. (This is also U. S. D. W. B. M. El. 435.00)	117.28	434.904	419.975	434.705
233	Copper plug, S. W. corner, bottom step, W. wing, towpath abutment, Brainard's Bridge, just W. of Oriskany	118.38	436.769	421.840	436.570
234	Copper plug in S. W. corner, bottom step, W. wing, towpath abutment, Kieley's farm bridge, 1¾ miles W. of Oriskany	118.98	436.023	421.094	435.824
235	Copper plug, S. E corner, bottom step, East wing, towpath abutment, Murphy's farm bridge, 3 miles W. of Oriskany	120.28	435.921	420.992	435.722
236	Copper plug, S. W. corner, bottom step, W. wing, towpath abutment, Clark's farm bridge, 4½ miles W. of Oriskany	121.68	437.063	422.134	436.864

TABLE No. 5—(Continued).

B. M. No.	DESCRIPTION.	Miles from [illegible]	Elevation above: Mean tide, New York, [illegible]	Elevation above: [illegible]	Elevation above: Mean tide, New York, [illegible]
[illegible]	Copper plug [illegible] towpath abutment [illegible] road bridge [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] square cut [illegible] towpath abutment [illegible] bridge [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Copper plug [illegible] wing, towpath abutment [illegible] farm bridge [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] wing, towpath abutment near [illegible] farm bridge [illegible] waste weir [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Copper plug [illegible] wing, towpath abutment [illegible] farm bridge [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] towpath abutment [illegible] farm bridge [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Copper plug [illegible] wing, towpath abutment [illegible] road bridge [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Copper plug [illegible] road bridge [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Bridge No. [illegible] road bridge, copper plug, lower step, E. wing, towpath abutment [illegible]	[illegible]	....	[illegible]	[illegible]
[illegible]	Bridge No. [illegible] road bridge, copper plug, lower step, E. wing, towpath abutment [illegible]	[illegible]	....	[illegible]	[illegible]
[illegible]	Bridge No. [illegible] road bridge [illegible] copper plug, second step, E. wing, towpath abutment [illegible]	[illegible]	....	[illegible]	[illegible]
[illegible]	Bridge No. [illegible] west road bridge [illegible] step, W. wing, towpath abutment [illegible]	[illegible]	....	[illegible]	[illegible]
[illegible]	Square cut on S. E. corner of parapet of [illegible] bridge No. [illegible] towpath side [illegible]	[illegible]	....	[illegible]	[illegible]
[illegible]	Bridge No. [illegible] bridge, copper plug [illegible] E. wing, towpath abutment	137.48	....	[illegible]	[illegible]
[illegible]	Culvert No. [illegible] square cut N. E. corner of coping, towpath side	137.64	....	414.557	[illegible]
[illegible]	Culvert No. [illegible] square cut N. E. corner of coping, towpath side	137.9[illegible]	....	414.685	[illegible]
[illegible]	Bridge No. [illegible] road bridge, copper plug, third step, E. wing, towpath abutment	138.11	....	[illegible]	[illegible]
[illegible]	Bridge No. [illegible] State road bridge, copper plug, second step, E. wing, towpath abutment	138.70	....	418.720	[illegible]
[illegible]	Square cut on N. E. corner of coping of culvert just east of Midland R. R. bridge, towpath side	139.04	....	414.231	428.961
[illegible]	Culvert No. 44, copper plug, N. E. corner, E. end of parapet coping, towpath side	139.74	....	414.651	[illegible]
257	Bridge No. 56, E. road bridge, Durhamville, copper plug, third step, W. wing, towpath abutment	140.71	....	419.865	[illegible]
[illegible]	Bridge No. 57, Main street bridge, Durhamville, copper plug, third step, E. wing, towpath abutment	140.88	....	418.743	433.473
259	Waste weir No. 4, square cut on S. E. corner of stone, N. end of coping of W. abutment	141.02	....	417.546	432.276
260	Bridge No. 58, Bennett's road bridge, Durhamville, copper plug, lower step, W. wing, towpath abutment	141.16	....	419.223	[illegible]

TABLE NO. 15—(*Continued*).

B. M. No.	DESCRIPTION.	Miles from Greenbush.	Elevation Above Mean tide, New York, 1900.	Elevation Above Greenbush, 1901.	Elevation Above Mean tide, New York, 1901.
261	Bridge No. 59, Shollhamer's road bridge, copper plug, second step, E. wing, berme abutment	142.08	....	420.288	435.018
262	Cowasselon aqueduct No. 3, copper plug near center of E. face of coping of buttress, E. wing, towpath side	142.66	....	416.325	431.055
263	Bridge No. 60, Lenox basin road bridge, copper plug, second step, W. wing, towpath abutment	143.78	....	418.161	432.891
264	Culvert No. 38, copper plug, coping of parapet over face of E. wing, towpath abutment	144.86	....	414.202	428.932
265	E. C. & N. R. R bridge at Canastota, point cut on projection of third course of masonry above ground, towpath abutment, near center	145.66	....	418.434	433.164
266	Bridge No. 61, Peterboro street bridge, Canastota, chisel mark on coping, berme vertical wall, W. side of bridge, foot of step	146.05	....	416.523	431.253
267	Bridge No. 62, Main street bridge, Canastota, copper plug, third step, E. wing, towpath abutment	146.24	....	419.170	433.900
268	Culvert at cider mill, Canastota, copper plug, N. E. corner coping of parapet, towpath side	146.92	....	415.392	430.122
269	Bridge No. 63. Beebes road bridge, copper plug, fourth step, E. wing, towpath abutment	147.80	....	419.147	433.877
270	Bridge No. 64, Herrick's road bridge, square cut on fourth step, E. wing, towpath abutment	148.29	....	419 403	434.133
271	Culvert No. 43, copper plug, N. W. corner, coping of parapet, towpath side at Fuller's bridge	148.88	....	414.974	429.704
272	Bridge No. 66, New Boston road bridge, copper plug, fourth step, E. wing, towpath abutment	149.75	....	419.503	434.233
273	Culvert No. 44, square cut on N. W. corner of coping of parapet, towpath side	150.44	....	414.161	428.891
274	Bridge No. 67, Canasaraga road bridge, copper plug, fourth step, E. wing, towpath side abutment	150.84	....	419.613	434.343
275	Bridge No. 68, Chittenango road bridge, square cut on second step, E. wing, towpath abutment	152.39	....	418.607	433.337
276	Chittenango Aqueduct No. 4, copper plug, stone under coping of parapet W wing towpath side	152.74	....	418.916	433.646
277	Culvert No. 45, square cut on N. E corner of coping of parapet, towpath side	152.96	....	414.357	429.087
278	Bridge No. 69, Bolivar road bridge, copper plug, stone under coping of buttress, W. wing, towpath abutment	153.61	....	420.200	434.930
279	Bridge No. 70, White's road bridge, copper plug, coping buttress, E. wing, towpath abutment	154.60	....	421.480	436.210
280	Bridge No. 71, Pool's brook road bridge, copper plug, coping buttress, E. wing, towpath abutment	155.79	....	421.200	435.930
281	Bridge No. 72, Kirkville road bridge, copper plug, coping buttress, E. wing, towpath abutment	156.94	....	421 690	436.420
282	Culvert No. 47, copper plug, N. E. corner coping, towpath parapet	157.42	....	412.316	427.046
283	Culvert No. 48, copper plug, N. E. corner of coping, towpath parapet	157.86	....	406.784	421.514
284	Bridge No. 73, Manlius road bridge, copper plug, lower step, E. wing, berme abutment	159.94	....	419.411	434.141

TABLE No. 15—(*Continued*).

B. M. No.	DESCRIPTION.	Miles from Greenbush.	ELEVATION ABOVE — Mean tide, New York, 1900.	Greenbush, 1901.	Mean tide, New York, 1901.
285	Bridge No. 74, Stearn's farm bridge, square cut, lower step, E. wing, berme abutment	160.38	....	420.962	435.692
286	Limestone Creek aqueduct, copper plug, S. W. corner of parapet coping, W. wing, towpath side	160.76	....	420.433	435.163
287	Bridge No. 76, Burdick's road bridge, square cut on coping of buttress, E. wing, towpath abutment	161.32	....	421.760	436.490
288	Culvert No. 49, square cut, N. E. corner coping parapet, towpath side	161.82	....	414.675	429.405
289	Butternut Creek aqueduct, copper plug, coping parapet, E. stone, E. wing, towpath side	162.83	....	420.183	434.913
290	Bridge No. 78, Thompson's Landing road bridge, copper plug, coping W. buttress, towpath side	165.04	....	419.785	434.515
291	Private bridge, paint cut on second step, E. wing, towpath side	166.70	....	417.909	432.639
292	Stop gate ½ mile E. of lock No. 47, copper plug, W. end of coping, towpath side	166.75	....	416.337	431.067
293	Lock No. 47, Syracuse, copper plug, S. E. hollow quoin, towpath lock	167.25	....	416.869	431.599
294	Lock No. 48, Syracuse, copper plug, S. E. hollow quoin, towpath lock	167.44	....	406.268	420.998
295	Bridge No. 80, William street bridge, Syracuse, copper plug, third step, E. wing, towpath abutment	167.81	....	398.960	413.690
296	Bridge No. 81, Catherine street bridge, Syracuse, square cut, W. of bridge seat on vertical wall, towpath side	168.09	....	397.903	412.633
297	Lock No. 49, Syracuse, copper plug, S. E. hollow quoin, towpath lock	168.15	....	395.973	410.703
298	Bridge No. 82, Orange street, Syracuse, square cut on second step, E. wing, towpath abutment	168.17	....	394.721	409.451
299	Bridge No. 83, Grape street, Syracuse, copper plug, third step, W. wing, towpath abutment	168.26	....	391.354	406.084
300	Weigh lock, Syracuse, copper plug, N. E. hollow quoin	168.42	....	389.154	403.884
301	U. S. G. S. B. M. at weigh lock, Syracuse, N. Y., tablet set in door sill of entrance to Collector's office	168.42	....	390.576	405.306
302	Bridge No. 86, Salina street bridge, Syracuse, square cut S. W. corner on belting of abutment 2½ feet above, towpath side	168.61	....	392.861	407.591
303	Bridge No. 87, Clinton street bridge, Syracuse, square cut on N. W. corner of E. foundation stone to stairway on towpath side	168.67	....	391.506	406.236
304	Bridge No. 89, West street, Syracuse, copper plug, in cap stone N. E. corner lift tower	168.96	....	391.814	406.544
305	Bridge No. 90, Geddes street, Syracuse, S. W. corner stairway landing pier, foot of W. towpath stairs and U. S. G. S	169.58	....	392.486	407.216
306	N. Y. C. R. R. bridge over Genesee street bridge, Syracuse, square cut on first step, S. wing, west abutment	170.25	....	389.936	404.666
307	Bridge No. 92, Bridge street, Syracuse, square cut on stone under coping, W. wing, towpath abutment	170.58	....	392.947	407.677
308	Discharge weir near Salt Company's bridge, copper plug, S. W. corner stone coping	170.95	....	390.304	405.034
309	Bridge No. 93, Blast Furnace road bridge, square cut on coping at buttress, W. wing, towpath abutment	171.46	....	394.094	408.824

TABLE NO. 15—(*Continued*).

B. M. No.	DESCRIPTION.	Miles from Greenbush.	Elevation Above: Mean tide, New York, 1900.	Greenbush, 1901.	Mean tide, New York, 1901.
310	Bridge No. 94, Gere's Landing bridge, copper plug, coping buttress, W. wing, towpath abutment	172.26	....	393.629	408 359
311	Culvert about 700 feet E. of lock No. 50, square cut on N. E. corner of parapet coping, towpath side	173.05	....	384.095	398.825
312	Lock No. 50, copper plug, S. E. hollow quoin between anchors, towpath lock	173.17	....	396.870	411.600
313	Bridge No. 95, Gere's road bridge, copper plug, lower step, E. wing, towpath abutment	173.35	....	402.213	416.943
314	Bridge No. 96, Belle Isle road bridge, copper plug, lower step, W. wing, towpath abutment	174.19	....	402.181	416.911
315	First culvert E. of Amboy road bridge, copper plug, W. end of parapet coping, towpath side	174 94	....	393.195	407.925
316	Bridge No. 97, Amboy road bridge, copper plug, lower step, W. wing, towpath abutment	175.08	....	401.922	416.652
317	Nine mile creek aqueduct, copper plug, N. W. corner of coping of E. retaining wall, towpath side	175.96	....	396.922	411.652
318	Culvert No 58, square cut, N. E. corner of coping, E. wall, first culvert E. of Camillus road bridge, towpath side	176.68	....	390.508	405.238
319	Bridge No. 98, Camillus road bridge, copper plug, lower step, W. wing, towpath abutment	177.10	....	402.820	417.550
320	Bridge No. 99, Newport road bridge, copper plug, lower step, W. wing, towpath abutment	179.21	....	402.829	417.559
321	U. S. G. S. B. M., Newport at Warners; Erie Canal bench-mark; S. W. corner of hotel barn, 30 feet N. of canal, chisel mark on boulder	179.23	....	398.840	413.570
322	Bridge No. 100, Memphis road bridge, copper plug, lower step, E. wing, towpath abutment	181.79	....	402.769	417.499
323	Culvert No. 59, ½ mile W. of Memphis, copper plug, coping of buttress, W. wing, towpath abutment	182.58	....	392.412	407.142
324	Bridge No. 101, Peru road bridge, copper plug, lower step, W. wing, towpath abutment	183.40	....	399.899	414.629
325	Bridge No. 102, Shanty Point road bridge, copper plug, third step, E. wing, towpath abutment	184.33	....	400.853	415.583
326	Carpenter Brook waste-weir, square cut on N. E. corner of coping of W. wall, towpath side	184.35	....	397.774	412.504
327	At Jordan Cement Works, square cut on S. E. corner of concrete foundation at end of R. R. siding at back angle of towpath	185.26	....	398.030	412.760
328	Bridge No. 103, Beaver St. Jordan, copper plug, lower step, W. wing, towpath abutment	186.60	....	400.273	415.003
329	Jordon Aqueduct, copper plug, coping of parapet, east wing, towpath side	186.87	....	400.546	415.276
330	Bridge No. 104, Main street, Jordan, copper plug, lower step, west wing, towpath abutment	186.96	....	399.393	414.123
331	Bridge No. 105, Hamilton street, Jordan, copper plug, lower step, east wing, towpath abutment	187.14	....	399.401	414.131
332	Lock No. 51, copper plug, southeast hollow quoin, towpath lock	188.07	....	396.883	411.613

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[illegible]	[illegible]	195.23	----------	[illegible]	[illegible]
[illegible]	[illegible]	195.65	----------	[illegible]	[illegible]
[illegible]	Bridge No. [illegible] street, Port Byron, copper plug, [illegible] step, E. wing, towpath abutment [illegible]	195.56	----------	[illegible]	[illegible]
[illegible]	Bridge No. [illegible] Canal street, Port Byron, copper plug, second step, E. wing, towpath abutment, U. S. G. S. B. M.	195.66	----------	[illegible]	[illegible]
[illegible]	Lock No. 52, Port Byron, copper plug, lower step, from W. end, S. side of lock pier, U. S. G. S. B. M.	195.87	----------	[illegible].535	[illegible]
[illegible]	Bridge No. 114, Houghtaling road bridge, copper plug, lower step, E. wing, towpath abutment	196.06	----------	[illegible].653	[illegible]
[illegible]	Bridge No. 119, McLeod's road bridge, copper plug, second step, W. wing, towpath abutment	196.58	----------	[illegible].607	[illegible]
[illegible]	Crane Brook aqueduct, copper plug, coping parapet, end of W. wing, towpath	196.70	----------	[illegible]	[illegible]

TABLE No. 15—(*Concluded*).

B. M. No.	DESCRIPTION.	Miles from Greenbush.	Elevation Above: Mean tide, New York, 1900.	Greenbush, 1901.	Mean tide, New York, 1901.
356	Bridge No. 120, Bucklin's farm bridge, square cut on third step, W. wing, towpath abutment.	198.81	....	382.622	397.352
357	Bridge No. 121, Salt street, Montezuma, copper plug, fourth step, W. wing, towpath abutment	199.81	....	383.678	398.408
358	Bridge No. 122, Change bridge, Montezuma, copper plug, second step, W. wing, towpath abutment	199.89	....	383.419	398.149
359	Bridge No. 123, Clark street, Montezuma, copper plug, third step, W. wing, towpath abutment	200.19	....	383.168	397.898
360	Seneca River aqueduct, A 12, Montezuma, copper plug, coping parapet, E. end, towpath side	200.64	....	383.460	398.190
361	Seneca River aqueduct, A 12, Montezuma, copper plug, coping parapet, W. end, towpath side	200.79	....	383.293	398.023
362	Bridge No. 124, May's Point road and Change bridge, copper plug, third step, W. wing, S. abutment	202.95	....	383.158	397.888
363	Bridge No. 124, May's Point road and Change bridge, U. S. G. S., tablet set in third step, S. abutment, W. wing	202.95	....	382.898	397.628
364	First culvert W. of May's Point bridge, square cut on S. W. corner of coping, towpath abutment	203.21	....	378 063	392.793
365	Second culvert W. of May's Point bridge, copper plug, coping of parapet, towpath side	204.22	....	380.071	394.801
366	Bridge No. 1, Western Division, Wayne county line bridge, point cut on projection of fifth course of masonry below coping, near center, towpath abutment	204.96	....	382.351	397.081

LIST

OF

BENCH MARKS

NEW YORK STATE CANALS

OSWEGO CANAL,

FROM SYRACUSE WEIGH LOCK TO OSWEGO.

FROM LEVELS OF 1900 AND 1901.

1901

TABLE No. 16.

List of Bench Marks. Oswego Canal, Syracuse Weigh Lock to Oswego. Syracuse to Lock No. 5, levels of 1901. Mud Lock to Phoenix, differences from levels of 1900. Phoenix to Oswego, differences from levels of U. S. D. W.

B. M. No.	DESCRIPTION.	Miles from weigh lock.	ELEVATION ABOVE. Mean tide, New York, 1900.	Greenbush, 1901.	Mean tide, New York, 1901.
0	Weigh lock, Syracuse, copper plug, N. E. hollow quoin	0	....	389.154	403.884
1	Willow street bridge, Syracuse, copper plug, third step, S. wing, towpath abutment	.17	....	393.068	407.798
2	Division street bridge, Syracuse, copper plug, third step, S. wing, towpath abutment	0.66	....	391.284	406.014
3	Bear street bridge, Syracuse, copper plug, first step, S. wing, towpath abutment	1.30	....	390.387	405.117
4	Lock No. 1, copper plug, N. E. lower berme hollow quoin	1.69	....	389.357	403.987
5	Lock No 2, copper plug, S. E. upper towpath hollow quoin	1.82	....	378.234	392 964
6	Lock No. 3, copper plug, N. E. lower towpath hollow quoin	1.94	....	367.052	381.782
7	Change bridge, square cut on coping buttress, N. wing, W. abutment	2.10	....	359.554	374.284
8	Change bridge, copper plug in W. side of coping, N. wing, E. abutment	2.51	....	359.994	374.724
9	R., W. & O. R. R. bridge, square cut on coping of buttress, S. wing, towpath abutment	3.51	....	358.094	372.824
10	Culvert, square cut on N. W. cap stone, towpath side	4.35	....	351.696	366.426
11	Liverpool road bridge, copper plug, first step, S. wing, towpath abutment	4.91	....	358.544	373.274
12	Culvert, square cut on N. W. cap stone, towpath side	5.97	....	351.375	366.105
13	Road and Change bridge, copper plug, first step, S. wing, towpath abutment	6.92	....	359.481	374.311
14	Lock No. 5, copper plug, N. E. lower towpath hollow quoin, between anchors	7.38	....	357.295	372.025
15	Copper plug in door sill of brick building 50 feet N. of E. wing of highway bridge over Seneca river, at Belgium	12.72	370.299	355.638	370.368
16	Copper plug on coping of guard lock, Phoenix, between straps on S. E. hollow quoin	17.00	365.334	350.678	365.408
17	Lock No. 6, copper plug, flush with masonry, between anchors on lower hollow quoin (T. P. side)	20.00	361.620	346.959	361.689
18	Lock No. 7, copper plug, flush with masonry, between anchors of middle hollow quoin (T. P. side)	22.33	354.460	339.799	354.529
19	At Fulton, N. Y., copper plug, flush with masonry on first step of S. wing wall of E. abutment of highway bridge on N. First street	27.70	323.420	308.759	323.489
20	Guard lock No. 4, copper plug, flush with masonry, between anchors of middle hollow quoin (T. P. side)	30.33	312.990	298.329	313.059
21	Lock No. 13, copper plug, flush with masonry, between anchors on N. E. lower hollow quoin (T. P. side)	33.47	302.230	287.569	302.299
22	Lock No. 15, copper plug, flush with masonry, between anchors on N. E. lower hollow quoin (T. P. side)	35.65	287.630	272.969	287.699
23	Top of iron bolt of masonry of old Government pier at the foot of W. Third street, 0.5 feet from E. face of pier, 3.5 feet N. of N. line of wooden dock leading to boat house; bolt is sunk one-half inch below top of masonry, and the letters "U. S." are obliterated by fresh masonry. This corresponds to bench mark "A" Oswego of the U. S. Lake Survey elevation 251.96	38.61	252.850	238.189	252.919

LIST

OF

BENCH MARKS

NEW YORK STATE CANALS

MIDDLE DIVISION,

SENECA RIVER,

FROM PHOENIX TO CLYDE.

FROM LEVELS OF 1900 AND 1901.

TABLE No. 17.

List of Bench Marks, Seneca River—Middle Division, Phoenix to Clyde. From Phoenix to B. M. 60 from levels of 1900 adapted to 1901 datum. From B. M. 60 to Clyde levels of 1900 corrected for new elevation at Clyde, determined by levels of 1901 and adapted to 1901 datum.

NOTE—Distances given are from Barge Canal Survey Station 0.0 at Three River Point.

B. M. No.	DESCRIPTION.	Miles from Three River Point.	Elevation Above		
			Mean tide, New York, 1900.	Greenbush, 1901.	Mean tide, New York, 1901.
	From U. S. D. W. B. M., at Phoenix, N. Y. To 1.8 miles east of Clyde, N. Y.				
53	U. S. D. W. B. M., at Phoenix, N. Y., a copper nail in root of oak tree, located about 750 feet S. W. in the direction of highway from the intersection of highways, about 200 feet east of bridge over Brandy Brook and about 150 feet S. E., at right angles to highway, from this highway also about 450 feet north of north edge of Oswego Canal....................................	North 2.80	858.990	844.329	859.059
54	Copper Plug on coping of Guard Lock No. 1, Phœnix, N. Y., between straps on the S. E. hollow quoin....................................	North 2.39	865.334	850.678	865.403
55	Copper Plug in step on east wing, north abutment of bridge over Oneida River at Three River Point....................................	00	867.031	852.370	867.100
56	Copper Plug in door sill of brick building 50 feet N. of the E. wing of highway bridge over Seneca River at Belgium	South 1.97	870.299	855.638	870.368
57	Nail in root of 20" elm tree on property of Henry Lacey, 350 feet from Italian shanty and 550 feet from place where ditch running into Seneca River crosses division line between lands of Henry Lacey and Luke Collins..................	3.84	865.575	850.914	865.644
58	Nail in root of elm tree located 220 feet from the dwelling of John Doyle at foot of bluff on flats S. side of Seneca River, one and one-eighth miles below Cold Spring Bridge................	5.40	870.439	855.778	870.508
59	Highest point on stone monument at Sta. 357+30.72, about 725 feet above Cold Spring Bridge, on the left bank of Seneca River..............	6.77	870.167	855.506	870,236
60	Nail in root of oak tree about 40 feet W. of wire fence on property of Jay B. Klein, about 6,000 feet above Cold Spring Bridge..................	8.17	866.993	852.332	867.062
61	Nail in root of 16" elm tree on back angle of tow-path on property of Jay B. Klein, 5 feet from wire fence about 1,500 feet W. of division line between properties of Alonzo Wagner and J. B. Klein....................................	7.85	867.841	853.178	867.908
62	Nail in root of 16" poplar, 170 feet E. of bridge over small creek and 350 feet from division line between properties of Harriet and Elmer Dixon and E. I. Bisdie, and on the property of E. I. Bisdie	9.98	868.223	853.555	868.285
63	Nail in root of 10" ash tree on left bank of Seneca River 300 feet from division line between properties of W. S. Names and Curtis Names, on property of W. S. Names, about 1,200 feet above D. L. & W. R. R. bridge, near Baldwinsville....	10.92	869.470	854.798	869.528
64	Point on Stone Monument near slaughter house, about 700 feet below lock in Baldwinsville side cut canal....................................	12.05	874.958	860.281	875.011
65	Point cut in coping on the S. side of last stone on the W. end of wall at the N. end of Baldwinsville dam.	12.88	877.258	862.578	877.308
66	Nail in root of elm tree on property of Otis M. Bigelow, one-half mile from Baldwinsville post-office, on the N. river bank..............	13.45	879.428	864.745	879.475
67	Highest point on boulder on top of river bank, on property of Mrs. Jennie M. Adsit, 550 feet from farm house and 420 feet from highway...	14.63	893.992	879.304	894.034
68	Mark cut on boulder 200 feet from water's edge, 15 feet from angle in rail fence between properties of Judson Maerfield and Hannah Butler, on Maerfield property..........................	15.74	877.244	862.552	877.282
69	Nail in root of elm tree 5 feet from river on the property of Adelbert and Frank Fowler, 1,075 feet from W. line and 1,100 feet from their E. property line about four miles above Baldwinsville, opposite property of Seneca River Brick Co	16.98	878.074	863.376	878.106
70	Nail in root of chestnut tree on land of D. E. Voorheese, 500 feet from Voorheese E. line and 2,000 feet from his W. line, Plainville, N. Y.....	18.67	881.572	866.867	881.597

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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] bridge [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] about 30 feet from [illegible] feet W of lower bridge in [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] bridge and about [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] stone of water tank [illegible] about 18 feet W of bridge over [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] ground at base [illegible] about one-half mile E of [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] abutment of highway bridge over [illegible] about three-quarters mile W of [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] W corner of bridge west of [illegible] bridge over [illegible] about 1 miles W of [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] of lower step, parapet [illegible] bridge over [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Culvert [illegible] miles E of [illegible]'s bridge, [illegible] W corner parapet wall, marked [illegible]		[illegible]	[illegible]	[illegible]

LIST

OF

BENCH MARKS

NEW YORK STATE CANALS

WESTERN DIVISION

ERIE CANAL,

FROM SENECA-WAYNE COUNTY LINE TO BUFFALO.

FROM LEVELS OF 1900.

TABLE No. 12.

List of Bench Marks, Erie Canal, Western Division, Seneca-Wayne County Line to Buffalo Light House B. M. Wayne County Line to Culvert No. 5, Levels of 1901. Culvert No. 5, to Buffalo Light House, Differences, from Levels of 1900.

TABLE No. 18—(*Continued*).

B. M. No.	DESCRIPTION.	Miles from Greenbush.	ELEVATION ABOVE Mean tide, New York, 1900.	ELEVATION ABOVE Greenbush, 1901.	ELEVATION ABOVE Mean tide, New York, 1901.
398	Dive Culvert (about 3.1 miles W. of Lyons), towpath, on parapet wall, marked [ ]	222.17	418.139	403.301	418.031
399	N. Y. C. R. R. Bridge (about 2.1 miles E. of Newark), E. wing, lower step, marked [ ]......	222.83	426.013	411.175	425.905
400	Dive Culvert (about 1.3 miles E. of Newark), towpath, on centre parapet wall, marked [ ]...	223.60	418.963	404.145	418.875
401	Lockville Lock No. 57, Newark, berme, on E. hollow quoin, marked [ ]........................	224.18	431.350	416.512	431.342
402	Middle Lockville Lock No. 58, Newark, berme, on E. hollow quoin, marked [ ]....................	224.29	439.655	424.817	439.547
403	Upper Lockville Lock No. 59, Newark, berme, on E. hollow quoin, marked [ ]....................	224.45	447.552	432.714	447.444
404	Charles Street Bridge No. 24, Newark, towpath, on E. wing, marked [ ].........................	224.92	448.879	434.041	448.771
U. S. G. S.	Newark Baptist Church, corner Charles and Miller streets, tablet in water-table, marked 457, O. S. W. G. O..	....	458.673	443.835	458.565
405	Waste weir, Newark, towpath, middle parapet wall, marked [ ]................................	225.38	446.841	432.003	446.733
406	Allerton's Highway Bridge No. 26 (about 1-8 mile W. of Newark), towpath, on E. wing, marked [ ]..	226.31	450.560	435.722	450.452
407	Peck's Highway Bridge No. 27 (about 1.9 miles W. of Newark), towpath, on W. wing, marked [ ].	226.88	449.875	435.037	449.767
408	Sweezey's Farm Bridge No. 28 (about 1.0 mile E. of Port Gibson), towpath, E. wing, first course below coping, marked O...............	227.53	449.877	435.039	449.769
409	Palmer's Farm Bridge No. 29 (about 0.5 mile E. of Port Gibson), towpath, on E. wing, marked [ ].	227.95	450.260	435.422	450.152
400	Port Gibson Bridge No. 30, towpath, on W. wing, marked [ ]..	228.47	450.154	435.316	450.046
411	Galloway's Highway Bridge No. 31 (about 2.8 miles E. of Palmyra), towpath, E. wing, on lower step, marked [ ]...................	231.04	450.675	435.837	450.567
412	Kent Street Bridge No. 31½, Palmyra, berme, on W. wing, on second lower step, marked [ ]....	232.88	450.048	435.210	449.940
413	R. R. Avenue Bridge No. 32, Palmyra, berme, on W. wing, marked [ ]............................	233.32	452.309	437.471	452.201
414	Church Street Bridge No. 34, Palmyra, towpath, on E. wing, lower step, marked [ ]............	233.82	443.558	403.720	418.450
415	Change Bridge No. 35 (about 1.2 miles W. of Palmyra), towpath, E. wing, N. side, marked [ ]..	234.50	449.671	434.833	449.563
416	Mud Creek Aqueduct (about 1.4 miles W. of Palmyra), towpath, W. wing, on buttress, marked [ ]	234.71	447.716	432.878	447.608
U. S. G. S.	Mud Creek Aqueduct (about 1.4 miles W. of Palmyra), towpath, W. wing, on buttress, copper tablet, marked 446 feet	234.71	447.733	432.895	447.625
417	Crandell's Highway Bridge No. 36 (about 1.8 miles W. of Palmyra), towpath, on E. wing, marked [ ]..	235.13	451.104	436.266	450.996
418	Clark's Farm Bridge No. 37 (about 2 miles E. of Macedon), towpath, E. wing, lower step, marked [ ].	235.49	451.199	436.361	451.091
419	Lock No. 60, Macedon, berme, on middle hollow quoin, marked [ ]...........	236.60	457.413	442.575	457.305
420	Lock No. 61, Macedon, berme, on middle hollow quoin, marked [ ]................................	237.44	464.550	449.712	464.442
421	Frear's Highway Bridge No. 41 (about 1.2 miles W. of Macedon), towpath, on W. wing, marked [ ]...	238.61	466.869	452.031	466.761
422	Wayneport Highway Bridge No. 42, towpath, on W. wing, marked [ ]	240.77	467.468	452.630	467.360
423	Knappsville Highway Bridge No. 43 (about 2.2 miles E. of Fairport), towpath, on E. wing, marked [ ]	243.06	468.572	453.734	468.464
424	Thomas Creek Culvert No. 26 (about 1.2 miles E. of Fairport), towpath, on center parapet, marked [ ]..	244.10	462.650	447.812	462.542
425	Baker's Highway Bridge No. 44 (about 0.5 mile E. of Fairport), towpath, on E. wing, marked [ ].	244.75	468.606	453.768	468.498
426	Waste Weir, Fairport, towpath, middle parapet wall, marked [ ]................................	245.25	467.358	452.520	467.250
427	Pullman's Basin Bridge No. 47 (about 1.1 miles W. of Fairport), towpath, on E. wing marked [ ]..	246.34	467.073	452.235	466.965
428	Pipe Culvert No. 27 (about 1.5 miles W. of Fairport), towpath, middle parapet wall, marked [ ]	246.76	457.117	442.279	457.009

TABLE No. 18—(Continued).

TABLE NO. 18.—(Continued).

TABLE No. 18—(*Continued*).

B. M. No.	DESCRIPTION.	Miles from Greenbush.	Elevation Above: Mean tide, New York, 1900.	Greenbush, 1901.	Mean tide, New York, 1901.
490	Gaines Basin Bridge No. 130, 1.70 miles W. of Albion, towpath abutment, W. wing, on lower step, marked [ ] with a chisel	296.87	515.885	501.046	515.776
491	Eagle Harbor Bridge No. 131, towpath abutment, E. wing, lower step, marked [ ] with a chisel	297.92	516.892	502.053	516.783
492	Eagle Harbor Bridge No. 131, towpath abutment, E. wing, lower step, copper bolt, marked U. S. G. S. B. M. 516 ft	297.92	516.899	502.060	516.790
493	Starkweather's Farm Bridge No. 132, 0.50 mile W. of Eagle Harbor, towpath, E. wing, marked [ ] with chisel	298.21	518.051	503.212	517.942
494	Long's Bridge No. 134, 1.8 miles E. of Knowlesville, E. wing, towpath abutment, face corner, marked [ ] with chisel	299.17	516.878	502.039	516.769
495	Dive Culvert No. 91, 0.50 mile E. of Knowlesville, towpath parapet, marked [ ]	300.39	511.811	496.972	511.702
496	Knowlesville Bridge No. 135, W. wing, towpath abutment, second lower step, marked [ ] with a chisel	300.97	517.815	502.976	517.706
497	Knowlesville Stop-gate, 1.75 miles W. of Knowlesville, E. abutment, towpath side, marked [ ]	302.69	514.804	499.965	514.695
498	Beal's Bridge, 1.8 miles E. of Medina, towpath abutment, E. wing, marked [ ] with a chisel	303.36	516.356	501.517	516.247
499	Hasting's Bridge No. 137, 1.0 mile E. of Medina, W. wing, towpath abutment, on corner coping, marked [ ] with a chisel	304.12	517.659	502.820	517.550
500	Holloway's Bridge No. 138, Medina, E. wing, towpath abutment, marked [ ] around anchor bolt.	304.77	517.058	502.219	516.949
501	Medina Aqueduct, Medina, W. buttress, on the N. W. corner, marked [ ] with a chisel	305.00	514.924	500.085	514,815
502	Church Street Bridge No. 139, Medina, E. wing, towpath abutment, marked [ ] around anchor bolt	305.14	516.598	501.759	516.489
503	Prospect Street Bridge No. 140½, Medina, E. wing, towpath abutment, copper bolt, marked U. S. G. S. B. M	305.62	518.387	503.548	518.278
504	Old Stop-gate, 0.70 mile W. of Medina, E. end of towpath abutment, marked [ ] with red paint.	305.85	515.522	500.683	515.413
505	Dive Culvert No. 100, 1.2 miles W. of Medina, on towpath parapet, marked [ ]	306.36	512.756	497.917	512.647
506	Jackson's Bridge No. 141, 2.0 miles W. of Medina, W. wing, towpath abutment, marked [ ] with a chisel	307.12	517.458	502.619	517.349
507	Shelby Basin Bridge No. 142, 2.7 miles W. of Medina, E. wing, towpath abutment, marked [ ] with a chisel	307.79	519.044	504.205	518.935
508	Gorman's Bridge No. 143, 1.70 miles E. of Middleport, E. wing, towpath abutment, marked [ ] with a chisel	308.54	518.993	504.154	518.884
509	Dive culvert No. 104, .60 mile E. of Middleport, on center of towpath parapet, marked [ ] with chisel	309.63	512.777	497.938	512.668
510	Main Street Bridge No. 145, Middleport, W. wing, towpath abutment, on lower step, marked [ ] with chisel	310.25	516.837	501.998	516.728
511	Dive Culvert No. 108, .80 mile W. of Middleport, on towpath parapet, end of coping, marked [ ] with chisel	311.06	510.014	495.175	509.905
512	Watson's Bridge No. 147, 1.70 miles W. of Middleport, W. wing, towpath abutment, marked [ ] with a chisel	311.94	517.821	502.982	517.712
513	Hurd's Bridge No. 148, 3.30 miles W. of Middleport, E. wing, towpath abutment, marked [ ] around anchor bolt	313.49	517.987	503.148	517.878
514	Reynold's Basin Bridge No. 149, 1.60 miles E. of Gasport, E. wing, towpath abutment, lower step, marked [ ] with a chisel	314.06	517.523	502.684	517.414
515	Dive Culvert No. 114, Gasport, towpath parapet, marked [ ] with chisel	315.46	511.649	496.810	511.540
516	Dive Culvert No. 115, Gasport, towpath parapet, marked [ ] with chisel	315.82	510.648	495.809	510.539
517	Orangeport Bridge No. 152, 1 mile W. of Gasport, W. wing, towpath abutment, marked [ ] with chisel	316.72	517.326	502.487	517.217
518	Dive Culvert No. 116, 1.50 miles W. of Gasport, towpath parapet, marked [ ] with chisel	317.27	509.862	495.023	509.753
519	Dive Culvert No. 117, 1.75 miles W. of Gasport, towpath parapet, marked [ ] with chisel	317.52	508.106	493.267	507.997

TABLE No. 18—(*Continued*).

B. M. No.	DESCRIPTION.	Miles from Greenbush.	ELEVATION ABOVE Mean tide, New York, 1900.	Greenbush, 1901.	Mean tide, New York, 1901.
520	Millard's Bridge No. 153, 3 miles W. of Gasport, E. wing, towpath abutment, marked [ ] with chisel..	318.69	521.919	507.090	521.820
521	Wakeman's Bridge No. 154, 2.80 miles E. of Lockport, W. wing, towpath abutment, on coping, marked [ ] with paint..................	319.55	521.753	506.914	521.644
522	Young's Bridge No. 155, 1.80 miles E. of Lockport. W. wing, towpath abutment, on coping, marked [ ] with paint	320.47	522.413	507.574	522.304
523	N. Y. C. & H. R. R. R. Bridge (Lower Town branch), Lockport, towpath abutment, E. end, rear corner, marked [ ] with chisel............	321.17	514.168	499.329	514.059
524	Adams Street Bridge No. 157, Lockport, towpath abutment, E. wing, lower step, marked [ ] with chisel..	321.46	516.759	501.920	516.650
525	Cady Street Bridge No. 160, Lockport, W. wing, towpath abutment, first lower step, marked [ ] with chisel..	321.88	517.648	502.803	517.533
526	Lock 67, Lockport, towpath, first lower step, marked [ ] with chisel..................	322.12	520.050	505.211	519.941
527	Lock 71, Lockport, E. berme, hollow quoin, marked [ ] with chisel.......................	322.22	571.777	556.938	571.668
528	200 ft. E. of bridge No. 165, 1.20 miles W. of Lockport, iron ring bolt at N. E. corner of plank towpath bridge over horse hole..........	323.68	576.202	561.363	576.093
529	2.70 miles W. of Lockport, on stone wall, marked [] with paint and improvement bench-mark No. 13¼..	324.96	578.684	563.845	578.575
530	Hawley's Bridge No. 167, 3.90 miles W. of Lockport, towpath abutment, W. end of pier, on first course of stone marked [ ] with chisel.....	326.23	576.034	561.195	575.925
531	Sulphur Springs Guard Lock, 1.50 miles E. of Pendleton, E. berme, hollow quoin, marked [ ] with chisel....................................	327.41	582.576	567.737	582.467
532	Pendleton Change Bridge No. 169, berme side, E. wing, E. end of lower step, marked [ ] with chisel.	328.94	576.492	561.653	576.353
533	Highway Bridge over Black Creek, 2.00 miles W. of Pendleton, W. abutment, N. W. wing, marked [ ] with chisel....................................	331.05	577.203	562.364	577.094
534	New Home Bridge No. 173, 3.0 miles W. of Pendleton, towpath abutment. W. wing, corner, first lower step, marked [ ] with chisel.........	331.74	577.690	562.851	577.591
535	Pickard's Bridge No. 174, 4.50 miles W. of Pendleton, towpath, on face of abutment, near W. end, marked [ ] with chisel	333.46	578.651	563.812	578.542
536	Stone Road Culvert 5.50 miles W. of Pendleton, N. E., corner, marked [ ] with chisel........ ...	334.46	576.519	561.680	576.410
537	Bush's Bridge No. 175, 4.0 miles E. of Tonawanda, on face of towpath abutment, marked [ ] with chisel and paint.........................	336.66	576.882	562.043	576.773
538	Erie R. R. Bridge, Tonawanda, towpath abutment, W. wing, first lower step, marked [ ] with chisel.	340.24	580.252	565.413	580.143
539	Tonawanda Dam, S. abutment, N. E. surface stone, between bolted iron bars, marked [ ]....	340.66	576.333	561.544	576.274
540	Bouck Street Bridge No. 180, Tonawanda, towpath abutment, W. wing, marked [ ] with chisel..	341.07	579.869	565.030	579,760
541	Tonawanda Change Bridge (Grand Island Ferry), No. 182, 1.10 miles W. of Tonawanda, E. wing, towpath abutment, first coping stone, marked [ ] with chisel	341.72	579.705	564.866	579.596
542	Three Mile Bridge No. 183, 3.00 W. of Tonawanda, E. wing, towpath abutment, marked [ ] with chisel	343.36	579.743	564.904	579.634
543	Cherry's Bridge No. 184, 3.60 miles W. of Tonawanda, towpath, W. wing, rear of abutment, second course below coping, marked [ ] with chisel and U. S. B. M., 218 with paint...........	344.39	577.405	562.566	577.296
544	Spies Bridge No. 185, 4.60 miles W. of Tonawanda, towpath abutment, E. wing, marked [ ] with chisel and U. S. B. M. 216 with paint	345.28	578.463	563.624	578.354
545	Grand Island Ferry (Scott's Bridge No. 186) 2.60 miles E. of International Bridge, Buffalo, W. wing towpath abutment, marked [ ] with chisel and U. S. B. M. with paint.................	346.25	579.324	564.495	579.215

TABLE No. 18.—(*Concluded.*)

B. M. No.	DESCRIPTION.	Miles from Greenbush.	Elevation Above		
			Mean tide, New York, 1900.	Greenbush, 1901.	Mean tide, New York, 1901.
546	Change Bridge No. 197, 0.07 mile E. of International Bridge, towpath, S. side of W. wing, marked [] with chisel and U. S. B M. No. 9, with paint	348.07	[illegible].758	[illegible]	580.594
547	Black Rock Guard Lock, S. side of W. hollow quoin, marked [] with chisel	348.58	577.670	563.340	577.570
548	International Bridge, Buffalo, towpath, on face of abutment, marked [] with chisel and U. S. B. M. No. 7 with paint	348.92	581.070	[illegible].340	580.970
[illegible]	Ferry Street Bridge No. 194, Buffalo, towpath abutment, W. wing, marked [] with chisel and U. S. B. M. No. 6 with paint	350.12	[illegible]	[illegible].050	[illegible].790
550	Porter Avenue Bridge No. 196, Buffalo, towpath, on face of abutment, bottom course, between fourth and fifth arch ribs, marked [] with chisel	351.27	577.400	563.650	577.880
551	Hudson Street Bridge No. 196½, Buffalo, towpath abutment, S. wing, first lower step, marked [] with chisel and U. S. B. M. No. 211 with paint	351.90	[illegible].085	[illegible].156	[illegible].916
552	Commercial Street Bridge No. 204, Buffalo, towpath abutment, N. wing, second lower step, marked [] with chisel	353.08	[illegible].734	[illegible].895	580.625
553	Lighthouse, upper surface of plinth, E. angle, marked by chiseling in stone so as to leave a rounded point (South U. S. Pier)	353.60	581.317	576.479	581.206
554	Westerly Subway under the N. Y. C. & H. R. R. R. at the head of gulf about 1 mile W. of Lockport, W. abutment, S. angle, lower course, projecting stone, marked []	323.86	581.600	570.720	581.450
555	U. S. L. S. Charlotte, upper side of water table of the lighthouse, at the S. E. angle, E. of S. window	271.00	294.118	[illegible].374	294.004

TABLE No. 19.

Champlain Canal.

Elevations of lower miter sills of locks.

Lock number.	Distance from junction.	Distance between locks.	Bench Marks.		Elevation of Lower Miter Sill.	
			Number.	Elevation + mean tide, New York.	Below bench mark.	Above mean tide, New York.
1	1.45		1	39.057		18.377
2	1.56	.11	2	50.457		29.815
3	2.36	.80	3	53.334		41.294
4	2.79	.43	4	54.365		43.060
5	5.04	2.25	5	63.090		43.170
6	5.84	.80	9	76.301		55.341
7	8.86	3.02	15	88.899		65.349
8	9.72	1.36	17	94.976		74.926
9	13.84	4.12	26	104.065		86.072
10	29.90	16.06	50	109.674		94.495
11	30.58	.68	61			94.006
12	31.96	1.48	64			104.107
13	33.19	1.23	69			113.630
14	35.88	2.69	75			126.296
15	41.40	5.52	90			132.690
16	53.10	11.70	110			133.035
17	53.18	.08	110			134.121
18	53.30	.17	111			116.919
19	56.54	3.24	114			114.969
20	59.51	2.97	119			114.614
21	65.06	5.55	129			104.896
22	65.07	.01	......			95.471
23	65.10	.03	130			95,596

Water surface of Lake Champlain September 12, 1901 = [illegible].

TABLE No. 20.

Champlain Canal.

Elevations of Spillways of Aqueducts and Waste-Weirs.

No.	NAME.	Location.	ELEVATION OF SPILLWAY ABOVE	
			Greenbush.	Mean tide, New York.
		Between Locks 4 and 5.		
1	Burton's (towpath)................	3.70 miles from junction........	34.030	48.760
		Between Locks 5 and 6.		
2	Spillway (berme)..................	5.15 miles from junction........	46.636	61.366
		Between Locks 6 and 7.		
3	Flynn (towpath)....................	8.30 miles from junction........	61.986	76.716
		Between Locks 7 and 8.		
4	Fitzgerald (towpath)..............	9.32 miles from junction........	68.754	83.424
		Between Locks 8 and 9.		
5	Mechanicville (towpath)..........	13.20 miles from junction.......	78.481	93.211
		Between Locks 9 and 10.		
6	Lansings or Stillwater (towpath)	15.11 miles from junction.......	86.948	101.678
7	Bemis Heights (towpath).........	17.86 miles from junction.......	86.881	101.611
8	Wilbers Basin (towpath)..........	20.01 miles from junction.......	87.118	101.848
9	Searles (towpath)..................	22.15 miles from junction.......	87.168	101.899
10	Coveville (towpath)...............	24.58 miles from junction.......	86.379	101.109
A1	Schuylerville Aqueduct...........	28.01 miles from junction.......	87.417	102.147
11	Bullards Bend (towpath)..........	29.78 miles from junction.......	87.762	102.492
		Between Locks 11 and 12.		
12	Towpath	31.57 miles from junction.......	96.313	111.043
		Between Locks 12 and 13.		
A2	Fort Miller Aqueduct..............	32.22 miles from junction.	103.339	118.069
		Between Locks 13 and 14.		
13	Bristols (towpath).................	35.00 miles from junction.......	106.848	121.578
		Between Locks 14 and 15.		
A3	Moseskill Aqueduct	35.97 miles from junction.......	123.410	138.140
14	Satterlees (towpath)	37.22 miles from junction.......	123.201	137.931
A4	Ft. Edward Aqueduct	40.75 miles from junction.......	122.965	137.695
		Between Locks 15 and 16.		
15	O'Brien's (spillway towpath)	42.53 miles from junction.......	133.151	147.881
16	Dunham's Basin (towpath)	44.50 miles from junction.......	133.151	147.881
17	Towpath	48.26 miles from junction.......	132.955	147.685
18	Smith's Basin (towpath)..........	49.15 miles from junction.......	132.138	146.868
19	Emples (berme).....................	50.72 miles from junction.......	132.679	147.409
		Between Locks 18 and 19.		
20	At Wood Creek (berme)	56.50 miles from junction.	110.608	125.338
		Between Locks 19 and 20.		
	Spillway	59.30 miles from junction.......	107.083	121 813
21	Just S. Lock 20 (berme)...........	59.30 miles from junction.......	106.954	121.684
22	At Lock 20 (berme)................	59.47 miles from junction.......	107.040	121.770
		Between Locks 20 and 21.		
23	Eastman's (towpath)	62.37 miles from junction.......	106.984	121.714
24	Maville (towpath)..................	64.24 miles from junction.......	106.785	121.515

TABLE No. 21.

Eastern Division — Erie Canal.

Elevation of Lower Miter Sills of Locks.

1	1.44	.....	4	10.960	....	—6.196
2	2.68	1.24	5	27.651	....	+6.578
Lower side cut, upper lock	.....	.....	...	....	....	+6.347
Lower side cut, lower lock	.....	.....	...	....	....	—7.022
Upper side cut, upper lock	.....	.....	...	....	....	+6.455
Upper side cut, lower lock	.....	.....	...	....	....	—6.291
3	7.96	5.36	14	36.569	....	18.304
4	8.25	0.29	15	49.715	....	29.420
5	8.52	0.27	16	60.498	....	40.938
6	8.73	0.21	17	70.497	18.798	51.704
7	8.86	0.13	18	80.143	18.604	61.589
8	9.02	0.16	19	90.393	19.074	71.819
9	9.35	0.33	20	100.326	18.512	82.014
10	9.53	0.18	21	110.470	18.701	91.769
11	9.69	0.16	22	120.480	18.704	101.776
12	9.84	0.15	23	130.549	19.918	111.651
13	10.04	0.20	24	140.446	19.002	121.464
14	10.26	0.22	25	150.404	16.512	131.592
15	10.53	0.27	27	160.531	15.807	141.724
16	10.72	0.19	28	170.472	18.990	151.549
17	11.04	0.32	29	180.511	18.668	161.948
18	11.23	0.19	30	190.893	19.247	171.646
19	20.09	8.86	48	199.312	16.968	182.329
20	24.83	4.74	50	209.206	18.862	190.346
21	26.05	1.22	52	222.298	23.340	198.958
22	26.23	0.18	53	232.103	20.170	212.083
23	33.15	6.92	72	240.320	16.786	223.534
24	33.94	0.79	74	248.748	17.157	231.586
25	37.74	3.80	83	255.691	16.840	239.751
26	44.12	6.38	90	264.459	16.793	247.657
27	44.32	0.20	91	273.402	16.910	255.492
28	49.54	5.22	95	280.641	16.837	263.524
29	51.51	1.97	96	287.985	16.450	271.535
30	52.14	0.63	101a	298.626	19.372	279.254
31	66.00	13.86	120	304.517	14.737	289.780
32	72.32	6.32	141	312.802	17.184	295.618
33	77.43	5.11	150	318.248	14.700	303.548
34	80.00	2.57	156	326.294	16.996	309.298
35	83.18	3.18	163	334.438	16.762	317.676
36	87.55	4.37	169	344.118	18.924	325.194
37	88.17	0.62	170	354.159	18.820	335.339
38	88.33	0.16	171	363.769	18.229	345.540
39	88.55	0.22	172	373.835	18.920	354.915
40	91.31	2.76	176	381.609	16.901	364.708
41	93.95	2.64	183	389.795	17.028	372.767
42	97.03	3.08*	191	396.994	16.020	380.974
43	97.29	0.26	192	407.015	18.142	388.873
44	100.00	2.71	200	415.078	21.070	397.008
45	101.24	1.24	204	427.960	20.038	407.927
Herkimer-Oneida county line	107.98	6.74	...	....	....	....

* Level between lock No. 41 and 42 is 2.86 miles by direct measurements, and 3.08 miles by line followed by the levels crossing Mohawk River twice between these locks.

TABLE NO. 22.

Eastern Division—Erie Canal.

Elevation of Spillway of Waste-Weirs.

No.	LOCATION.	Elevation of Spillway above Greenbush.	Elevation of Spillway above Mean tide, New York.
1	3.85 miles west of Lock No. 1	11.357	26.087
2	Abandoned.		
3	0.03 miles east of Lock No. 4	22.233	36.963
4	0.05 miles east of Lock No. 10	84.331	99.061
5	0.28 miles west of Lock No. 18	174.742	189.472
6	0.15 miles west of Lock No. 20	193.419	208.149
7	Abandoned.		
8	2.04 miles west of Lock No. 27	256.431	271.161
9	13.70 miles west of Lock No. 30	281.841	296.571
10	0.03 miles west of Lock No. 33	302.419	317.149
11	0.25 miles west of Lock No. 33	302.270	317.000
12	3.58 miles west of Lock No. 35	318.266	332.996
13	0.03 miles west of Lock No. 36	328.344	343.074
14	0.20 miles west of Lock No. 39	358.503	373.233
15	0.13 miles west of Lock No. 41	374.445	389.175
16	At Lock No. 43	390.296	405.026

TABLE NO. 23.

Eastern Division—Erie Canal.

Elevation of Spillway of Aqueducts.

No.	NAME.	Location.	Elevation of Spillway above Greenbush.	Elevation of Spillway above Mean tide, New York.
1	Lower Mohawk	Between locks 18–19	174.159	188.889
2	Upper Mohawk	Between locks 22–23	216.092	230.822
3	Flat Stone Creek, Van Slyck's	Between locks 24–25	232.284	247.014
4	Sansai kill, Pattersonville	Between locks 25–26	239.652	254.382
5	Schoharie Creek	Between locks 30–31	282.502	297.232
6	Tokkon Creek	Between locks 30–31	282.267	296.997
7	Leonardson's Creek, Yatesville	Between locks 30–31	282.322	297.052
8	Lasher's Creek	Between locks 30–31	282.250	296.980
9	Plattkill Creek, Sprakers	Between locks 31–32	287.825	302.555
10	Canajoharie Creek	Between locks 31–32	288.255	302.985
11	Otsquago Creek, Fort Plain	Between locks 32–33	296.699	311.429
12	Castle Creek, Indian Castle	Between locks 35–36	318.437	333.167
13	Fulmer's Creek, Mohawk	Between locks 43–44	390.296	405.026
14	Steele's Creek, Ilion	Between locks 43–44	390.289	405.019
15	Moyer's Creek, Frankfort	Between locks 44–45	411.090	425.820
16	Ferguson's Creek	Between locks 44–45	411.242	425.972

TABLE No. 24.

Middle Division—Erie Canal.

Elevations of Lower Miter Sills of Locks.

LOCK NUMBER.	Distance from Greenbush.	Distance between locks.	Bench Marks.		Elevation of Lower Miter Sill.	
			Number.	Elevation, +Mean tide, New York.	Below bench mark.	Above Mean tide, New York.
Herkimer-Oneida county line.	107.98	....	....	....	....	....
46	111.85	3.87	228	431.059	14.174	416.885
47	167.25	55.90	293	431.599	19.440	412.159
48	167.44	0.19	294	420.998	19.096	401.902
49	168.15	0.71	297	410.703	17.974	392.729
50	173.17	5.02	312	411.600	18.907	392.693
51	188.07	14.90	332	411.613	14.570	397.043
52	195.87	7.79	352	404.265	18.552	385.713
South line of Wayne county..	204.96	9.09	....	....	....	....

TABLE No. 25.

Middle Division—Erie Canal.

Elevations of Crest of Waste-Weirs.

Number.	NAME.	Location.	Elevation of Crest Above	
			Greenbush.	Mean tide, New York.
1	Ballou Creek....................	109.87 miles west of Greenbush.....	411.447	426.177
2	Between Rome and Oriskany..	121.50 miles west of Greenbush.....	414.759	429.489
3	Fort Bull.........................	127.86 miles west of Greenbush.....	414.632	429.362
4	Durhamville	141.02 miles west of Greenbush.....	414.554	429.284
5	Carpenter Brook....	184.35 miles west of Greenbush.....	395.072	409.802
6	Weedsport	191.25 miles west of Greenbush.....	389.613	404.343

TABLE No. 26.

Middle Division—Erie Canal.

Elevation of Spillway of Aqueducts.

No.	NAME.	Location.	Elevation of Spillway Above	
			Greenbush.	Mean tide, New York.
1	Sauquoit Creek........	113.58 miles west of Greenbush	415.514	430,244
2	Oriskany Creek........	117.28 miles west of Greenbush	414.429	429.159
3	Cowasselon Creek.....	142.66 miles west of Greenbush	414.409	429.139
4	Chittenango Creek	152.74 miles west of Greenbush	414.588	429.318
5	Limestone Creek	160.76 miles west of Greenbush	414.616	429.346
6	Butternut Creek	162.83 miles west of Greenbush	414.903	429.633
7	Nine Mile Creek	175.98 miles west of Greenbush	394.991	409.724
8	Jordan	186.37 miles west of Greenbush	395.271	410.001
9	Centerport.............	192.85 miles west of Greenbush	389.513	404.243
10	Port Byron	195.45 miles west of Greenbush	390.203	404.933
11	Crane Brook	198.70 miles west of Greenbush	379.788	394.518
12	Seneca River	200.64 miles west of Greenbush	378.361	393.001

List of Hydrographs Accompanying Report on New York Stream Gaugings for the Year 1901.

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